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Commercial Editor: A. H. BRIDGE. *Joint Managing Directors:* G. H. ALABASTER, Assoc.I.E.E. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Manager and Secretary:* E. S. MIDDLETON

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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The Training of Apprentices.

WE review elsewhere two pamphlets published by the City and Guilds of London Institute, outlining its revised courses for electrical installation work. The syllabus was drafted in conjunction with the Electrical Contractors' Association, which has officially adopted it as a guide to the technical training of its members' indentured apprentices. Such a standard has long been wanted. The mediæval idea that an apprentice should learn his trade solely by observing and imitating the rule-of-thumb methods of a more or less skilled journeyman still persists in many quarters. It is a method which has turned out good men; but men, for the most part, cleverer with their hands than with their heads. That is not enough in a trade such as electrical contracting, which, with every year, makes increasing demands on the intelligence of its workers. While it is true that no man can learn to wire a building, any more than he can learn to play the violin, from reading a text-book, yet no man can count on rule-of-thumb methods to carry him through all the complexities of modern installation work. If he wants to be more than a mechanical drudge obeying orders blindly, if he aspires to be a competent charge-hand or a foreman, he must somehow or other acquire, in addition to manual skill, a sound theoretical knowledge of the principles which govern his work, from the wiring of a simple bell circuit to the equipment of a three-phase power board. He can only gain that knowledge, systematically and thoroughly, by supplementing the practical experience afforded by the old system by a course of technical training such as that covered by the syllabuses under review.

An interesting feature of the complete scheme is the provision it makes for the elementary training of boys between fourteen and sixteen, in the two difficult years between the school-leaving age and the age when they are old enough to be bound apprentices. The designers of the scheme, recognising that our system of state education utterly fails to turn out boys trained in accurate observation and clear expression, set out, in the two part-time years of the preliminary course, to make good the defects of ten full years of largely wasted schooling It is lamentable that such a programme should be necessary; but that it is, no one with any experience of the average product of our extravagant elementary school

system will deny. To see clearly, to think clearly, to speak and write clearly—that is the larger ideal of all education; and because our school boards fail to appreciate it, the practical men of the City and Guilds of London Institute and of the Electrical Contractors' Association have been forced to devote a good half of their syllabus to its achievement.

It would be difficult to suggest a syllabus better designed to discipline the muddled, discursive, incoherent mind of the average boy of fourteen or fifteen; that is, if he can be persuaded to embark on it. It will surely be an unusual boy who will look forward two years to the time when he will enter a trade from which, for that time, he is debarred; or who, having done so, will continue steadfast in his training, against the temptation to drift into a chance avenue leading to some other, and perhaps less satisfactory, livelihood. We must rely presumably upon parental authority for the necessary prescience and persistence; but it is a pity that, as things are, no means can be readily devised to secure at once the school-leaving boy to the trade he is to follow, instead of allowing him to waste two years in a blind-alley occupation, and perhaps losing him at the end of them.

The future of the electrical contracting industry depends largely upon the youth we are training now. We want to catch them young and train them long, to a safe, sound, and intelligent standard of workmanship whose average shall be as much higher than to-day's as to-day's is than yesterday's. The very complete scheme of training which the Electrical Contractors' Association has now fathered will go largely to secure that higher standard; and everyone who appreciates the importance to the industry of good installation work must give it the whole-hearted support it deserves. It is to be hoped that not only the members of the Association, but all reputable electrical contractors, will adopt it as an essential part of the training of their indentured apprentices, and will take steps to see that they do not only take up these or similar classes, but remain in them, and work seriously towards the attainment of a certificate. That may mean a little trouble—something more than the perfunctory interest which is all that many employers give to the technical progress of their apprentices—but if it be accorded widely and continuously it will surely result, and very soon, in a definitely better grade of electricians, careful, skilful and intelligent.

Any scheme of training depends, of course, largely on the apprentices themselves. Employers may drive and parents insist, but if the lad himself is indifferent or unwilling, mere attendance at a night school will not teach him anything but scrimshanking. It is not always easy to persuade light-hearted youth that the battle of life is to be won or lost from its beginning in the teens, and the Electrical Contractors' Association has therefore wisely added a concrete incentive to industry and application. It awards each year a gold medal and £20, and a number of other medals and money prizes, to the indentured apprentice who achieves the best results in the final examination of the City and Guilds of London Institute. These are useful spurs to ambition; but worth more than any money prize, however generous, to the young man who has the grit to follow the courses to their certificated end, is the mental equipment he will gain, not only to help him to the higher posts of his trade, but also to open to him the wider horizons of a fuller life.

Pointers and Grouses.

Can one look at a modern electric cooker without being reminded of a gas cooker? Perhaps the gas people drew their inspiration from the old-fashioned kitchen range, but must we remain so unoriginal and unenterprising?

Will our inventors and manufacturers please hasten to lift electric cooking into the plane of the electric motor, and give it a new design of its very own? They may need high-frequency current and water-cooled coils for the real electric cooker of the future, but the water cooling system might serve to feed the domestic hot-water supply and the oven or saucepan might be nothing but a paper bag which would be dropped into the embrace of a high-frequency coil. In, say, three minutes, the whole meal would be cooked from within, instead of by the long and extravagant process of heat application from without.

When will electric washer manufacturers break away from the mechanical medium? Why not make clothes-washing an entirely electro-chemical process? High-frequency, of course! Violent ebullitions and soap for the washing; then drop out the third rinsing water and dry the clothes within the same coil and container. Nothing mechanical, no wringer. Ozonised laundry!

Makers of electric washers do not even make heat provision a part of their design. The water has to be separately boiled and then transferred to the washer.

Practical men must continue to apply themselves to those ready means of development which are immediately to hand, but who would deny us our flights of fancy? We need decry nothing, neither should we miss any opportunity of trying out new ideas, or experimenting with novel apparatus. In this romantic age development is so rapid and so stimulating that there are few of us who cannot sense a much wider and fuller application of electricity than we know of to-day.

Domestic Electrical Appliances in France.

Before the average Englishman has lived in France for many years, sometimes a few months will suffice, he is impressed with the peculiar way the conditions of French life seem to be out of joint with what are understood to be French ideals. Brilliant discoveries have been made in France in both pure and applied science, in radium and radiology, in the early development of the submarine, the internal-combustion engine, in aeroplanes and hydroplanes, in metallurgy, yet in ordinary living conditions France is behind some European nations which are not regarded as her equals in intellect.

In electricity development progress has been rapid as regards illumination, and the number of villages which are being provided with energy for this purpose is increasing every day; the advantages of electric power are appreciated, alike by industrialists and agriculturalists, but in some respects France is very much behind the times in the application of electricity to modern needs. For domestic purposes, for example, owing to ignorance, electricity is usually regarded as a luxury obtainable only by the wealthy classes. This attitude is being modified by means of exhibitions and other forms of publicity, but progress has been retarded in the past owing to the domestic appliances placed before the French public having been imperfect.

With a view to overcoming defects and avoiding the disfavour which such a state of affairs must necessarily bring to electricity generally, an organisation has been created under the auspices of the electricity suppliers in Paris, and is now supported by practically all the other important electrical authorities in France, which is called the Société AP-EL. This organisation has formulated the conditions which should be observed in the construction and installation of electrical domestic appliances with the object of ensuring that such apparatus shall be capable of giving satisfaction to its users. This preliminary work is really in the nature of standardisation, and covers recommendations and stipulations concerning safety, convenience, economy, strength of construction, durability, and facility of repairs. Those articles which are submitted for approval to the laboratories of the Société AP-EL and are found satisfactory will be certified as being efficient by means of a stamp, or mark, and when the preliminary work has been brought to a satisfactory point of development the organisation proposes to undertake intensive advertising propaganda to encourage the use of electrical appliances for domestic purposes.

Electricity Supply in Worcester.

An outline of a progressive municipal undertaking's activities, including details of an unusual type of powdered-coal-fired boiler and the methods utilised for supplying electricity in rural districts.

THE Worcester Corporation Electricity Department operates under an Order of 1890, and an extension Special Order of 1925 that enabled it to enter into an agreement with the Shropshire, Worcestershire and Staffordshire Electric Power Co. to enlarge its area of supply beyond the city boundary so as to include

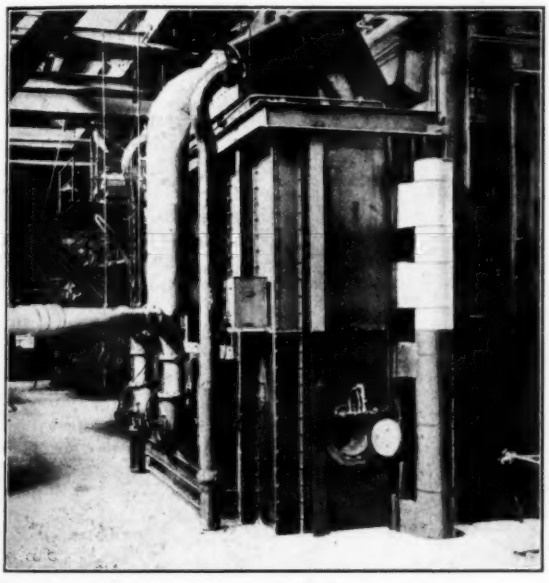


Fig. 1.—Pulverised-coal-fired Boiler.

12 villages. The agreement was approved of by the Electricity Commission and included in the constitution of the South-West Midlands Electricity District.

The Worcester Electric Traction Co., Ltd., purchased energy (305,449 kWh in 1927-28) from the undertaking until the Corporation acquired the tramway system and closed it down in May, 1928, it being superseded by petrol-driven motor omnibuses.

The Malvern Urban District Council commenced to purchase energy in bulk from the Corporation in May, 1924.

Power Stations.—Two generating stations are in use, one hydraulic and the other steam driven, of a total capacity of 13,770 kW. In 1927-28 the energy generated totalled 14,154,931 kWh (of which 695,922 kWh was hydro-electric), the maximum demand reached 6,652 kVA and the load factor 24.22 per cent.

The Powick station houses two water turbines, one driving direct a Westinghouse 250-kW alternator and the other rope-driving a B.P. 70-kW dynamo. A second water-power site has been acquired for possible future development.

The Hylton Road station originally contained Babcock & Wilcox boilers, with Riley retort stokers, which generated steam for the Belliss triple-expansion engines driving Bruce Peebles and E.C.C. alternators (one 250- and three 400-kW sets) and two B.T.H. 1,500-kW turbo-alternator sets.

In 1922 the Corporation acquired from the Government Disposals Board a 3,000-kW B.T.H. turbo-alternator, three Stirling boilers, economiser, boiler-feed pumps, and other accessories. The Department's staff was increased and, with direct labour, the whole of the plant was dismantled at Southampton, transported to Worcester, and re-erected in an extension of the power house, the construction of which was mainly undertaken by direct labour. The turbine was originally designed for 3,300 volts, three-phase, but before re-erection its stator was rebuilt for 6,600 volts, three-phase. While re-erecting one of the boilers, each of which had 6,327 ft. of heating surface, with superheaters, its capacity was increased by the introduction of a greater length of tubes, the heating surface being increased to 8,136 sq. ft., and one boiler was fitted with a Riley 9-retort underfeed type of stoker and longer superheater tubes were fitted; the other two boilers were only erected in skeleton form.

That plant was put in commission during 1923, but the successful introduction of a very low two-part tariff and a growing power load so increased the demand on the system as to necessitate the installation during 1927 of a B.T.H., 3,000-r.p.m., 7,500-kW (m.c.r.) turbo-alternator. It is a modern set of standard design, steam being bled from the turbine and employed in parallel with that used for condenser air ejection for evaporating the boiler feed water; and substantial economies resulted from its operation during the last four months of 1927-28, in conjunction with cheaper fuel, the average cost of generation having been reduced from 1.06d. to 0.71d. per kWh sold.

The newer station switchgear is of the B.T.H. stone-cell pattern with duplicate busbars; the older "home made" gear is to be re-utilised in sub-stations. Auxiliary plant is both steam and motor driven, a feature being the concentration of the steam-driven plant in one room which is insulated to prevent the escape of hot air from it, all of which is conveyed to the boilers by their forced-draught fans.

Pulverised Fuel.—In 1922 when the extension of the generating plant was receiving consideration, the possibility of employing powdered coal in place of stoker

Fig. 2.—Horizontal Turbulent Pulverised-fuel Burners in Front Wall.

firing was investigated; the majority of the then existing plant in England was examined, and in 1925 Mr. C. M. Shaw, M.I.E.E., city electrical engineer, inspected up-to-date plant in several large American stations. Despite contentions to the contrary, especially in the case of small plant, he formed the decided opinion that

pulverised fuel, if properly handled, offered great possibilities of lowering production costs.

Investigation having shown the cost of the storage bin system to be prohibitive, he adopted "unit" mills,

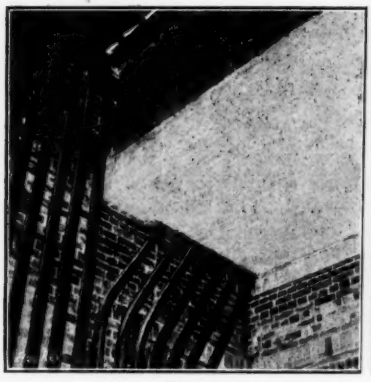


Fig. 3.—Furnace Arch and Brickwork.

Fig. 4.—Water-tube "Wall" during Construction.

and two "Atritor" 2-ton pulverisers (Alfred Herbert, Ltd.) driven by B.T.H. 50-h.p., 1,465-r.p.m., three-phase, 50-cycle, 440-volt motors have been installed on the boiler-house firing-floor level, their maximum combined capacity being 5.8 tons of powdered coal per hour. Each mill feeds directly one of two Riley turbulent flare burners, each of three tons per hour maximum capacity, which project horizontally through the front of the Stirling boiler opposite, as shown in figs. 1 and 2 (see Table I for details). The burners are lighted by feeding the ignition tubes with paraffin through a 0.25-in. pipe and a flame torch held in the furnace, the pulverisers being started immediately. The operation is usually completed in three minutes, and in about 10 minutes the boiler will commence to raise steam, reaching the full 200 lb. per sq. in. pressure in from 30 to 40 minutes. At present the ash is raked from the furnace hopper into barrows; it is very friable and presents little difficulty.

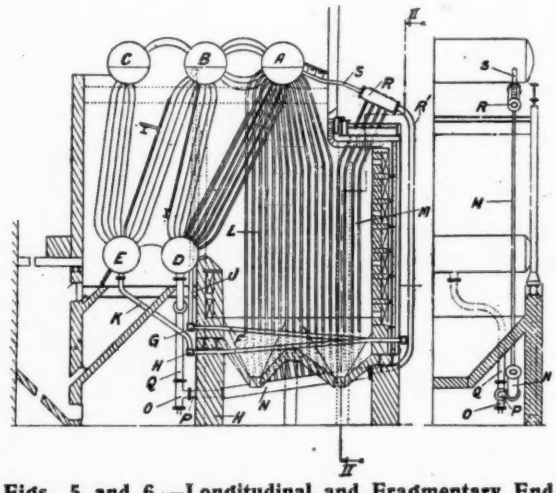
Water-wall Tube Screens.—The novel feature of the boiler is the manner in which the furnace walls are screened with water tubes of a simple form, designed and patented by Mr. C. M. Shaw himself, the nature of the invention, which relates to semi-vertical tube boilers, being declared in British patent specification No. 266,566 to be as follows:—

The connection of a portion of the tubes constituting the usual water screen of known construction to the front upper steam drum and lower mud drum in such a way as to add those tubes to the boiler's direct water-circulatory system, thus constituting a very extensive steam-generating surface.

Table I.—Stirling Boiler Details.

Heating surface	8,136	sq. ft.
Water walls: tube area	988	,, ,,
effective heating surface ...	853	,, ,,
combined effective heating surface of boiler and water walls	8,989	,, ,,
Superheater: surface	1,476	,, ,,
effective surface	1,100	,, ,,
Furnace: volume (15×14×23 ft.)	4,830	cu. ft.
wall surface area	1,532	sq. ft.

Referring to figs. 3, 4, 5 and 6, which illustrate the application of the invention, A, B and C denote the transverse steam drums and D and E the mud drums (the usual water screen denoted by F G H J K is not used in the Worcester plant). At each side of the wall of the combustion chamber is located a water wall composed of rows of upright tubes L, M, connected at their lower ends where they extend outside the ash hoppers to a longitudinal header N, which is connected to a branch piece O by a tube P, branch O being connected with the mud drum D by a tube Q. Tubes L constituting a portion of the water wall are connected at their upper ends with the front upper drum A, certain of them being expanded into holes in the drum which would ordinarily serve for the connection of the tubes of the front bank and for the water-circulating tubes between the front and middle, or rear, upper drums. Thus holes for three of the cross tubes and five of the tubes of the front bank at each side are utilised for the upper ends of the water wall. The second portion of tubes M are connected at their upper ends to a header R, which in turn is connected with the drum A by tube S. The headers N and R may be connected by balancing pipes R^1 as shown, and the tubes constituting the water wall at each side may, in lieu of being extended through the ash hopper, be extended at their lower ends through the side walls and be connected to headers located externally of such side walls.



Figs. 5 and 6.—Longitudinal and Fragmentary End Sectional Elevations of Boiler.

Air-cooled Walls and Floor.—The boiler is provided with a "Liptak" suspended furnace arch (fig. 3) and hollow walls and floor. In cooling them the air therein reaches a temperature of from 250 to 400 deg. F., and is used for drying the coal, the hot air being then delivered by the pulveriser fans to the burners, thus constituting the primary combustion air. The forced-draught fans drive air through a duct under the boiler-house floor along three paths as follows:—

No. 1 (side-walls) circuit pipe at the left boiler front corner feeds an air box along the top of the furnace

Fig. 7.—Floor Air Ducts, No. 8 Boiler.

(fig. 8; front elevation), whence it passes down between the back two r.s.j. arch supports and over the top of the flat arch, emerging into a pipe (fig. 8, sectional side

elevation) down the centre of the boiler front; it then enters the two top passages of the hollow wall at the front, immediately dividing to left and right along the front wall and round the side walls, thence down a pipe on each side of the boiler (fig. 8, front elevation) into transfer pipes; it enters the hollow walls again along the side passages until it reaches the front corners, where it joins the final duct of No. 2 path.

No. 2 (back-wall) circuit starts in a pipe along the left-hand side of the boiler, the air passing into the hollow back wall at the firing-floor level (fig. 8, back elevation) and through a series of three ducts (fig. 8, back elevation); it then enters on the right furnace-floor tubes that terminate in a similar duct at the left, where it rises into two ducts in series in the front wall and joins No. 1 path.

No. 3 (floor) circuit starts (fig. 8, front elevation and sectional plan A A) at the back left corner, the air passing towards the front through three ducts in series, ending at the right front corner, where it joins the inlet duct of the furnace-floor tubes.

The hollow walls are of "Liptak" design, but the floor ducts (fig. 7) and tubes are supplementary and experimental (provisionally protected by Mr. C. M. Shaw), the tubes being covered with fire bricks and slabs of cast iron, to determine which has the longer life. When the boiler is started, hot gases may be withdrawn direct from the furnace through the separate fire-brick-lined pipe shown at the side of fig. 8 (sectional side elevation) which supplementary means of heating may also be used occasionally at light load when it is not desirable to cool the brick-work by drawing excessive quantities of air through the hollow walls and floor passages. Thus the temperature of the air employed for coal drying and combustion may be raised to a total of 500 deg. F. if necessary.

Boiler Performance.—Originally designed for the Stirling standard rating of 27,000 lb. per hour, after having been adapted for burning powdered coal by enlarging the combustion chamber, adding the water walls, and 3 ft. longer tubes, the steaming capacity has reached 60,000 lb. evaporation per hour, the superheat obtained ranging from 200 to 250 deg. F. At that rating the water level remains quite steady, and the boiler shows no signs of being forced; CO_2 readings indicate from 14 to 16 per cent. The above rating equals 18,350 B.th.u. per cu. ft. of furnace space per hour; the furnace loading with four tons of fuel per hour would equal 19,800 B.th.u. per cu. ft. per hour for 62,000 lb. evaporation per hour (in American practice the figure reaches 27,000 B.th.u. per cu. ft. per hour). The calculation is based on an average net fuel calorific value of 10,000 B.th.u. per lb. as received, with 10 per cent. moisture content; but is by no means the limit, for the original damper has restricted the loading. The furnace volume being ample for a much higher rate of combustion, the provision of a larger damper should enable the maximum capacity of the pulverisers (*i.e.*, 5.8 tons per hour) to be utilised, which is hoped to increase the rating to nearly 75,000 lb. evaporation per hour in case of emergency.

Modifications contemplated in the case of other boilers, together with details of the modernisation of the undertaking's electricity distribution system, will be referred to next week; as will also the efforts that are being made to stimulate the use of electrical energy in the rural area surrounding the City of Worcester, and the means by which it is being successfully distributed for domestic and farming purposes in country districts with the aid of overhead copper transmission and distribution lines of comparatively large dimensions.

(*To be concluded.*)

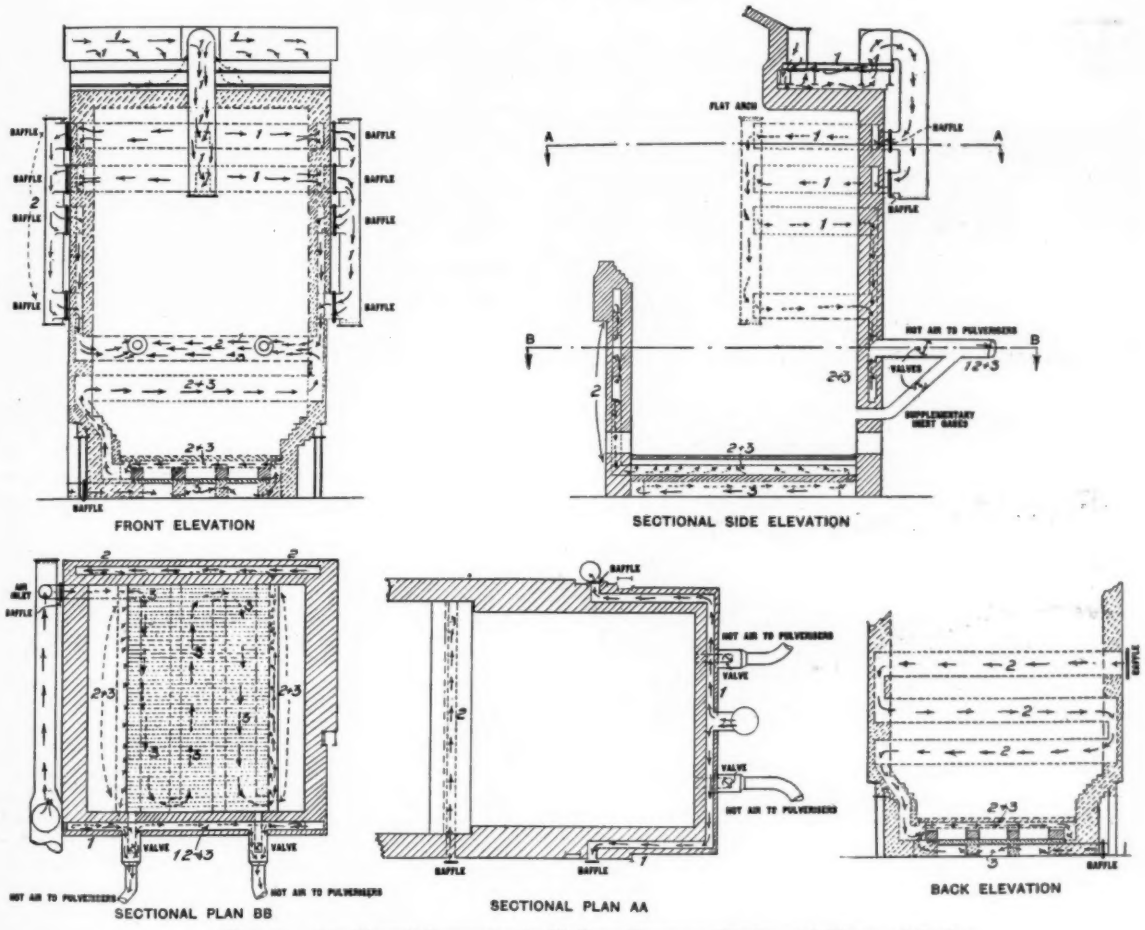


Fig. 8.—Air Circuit Passages in Hollow Furnace Walls and Floor of Boiler.

High-Voltage Transformers.

Brief details of 132-kV "Metrovick" transformers and switchgear for the Central Scotland section of the national "grid" System.

WHILE the construction of 132,000-volt equipment in this country is not new, such apparatus having been supplied by the Metro-

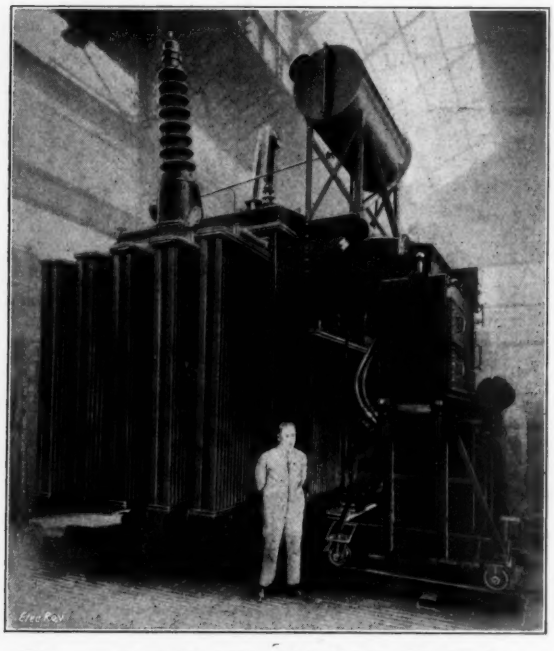


Fig. 1.—A 15,000-kVA, 20/132-kV, Single-phase Transformer.

politan-Vickers Electrical Co., Ltd., for service in South Africa, the British "grid" equipment will be the first of its kind to be seen in operation in the British Isles.

The accompanying photographs show some Metropolitan-Vickers transformers and switchgear for the Central Scotland section of the "grid," which section was the first to be undertaken and has made rapid progress; much of the structural work of the transmission towers and the sub-stations has been completed, or is well advanced, and a considerable amount of the apparatus is on site. The equipment being supplied by the above-named company for this section includes large-capacity transformers, *viz.*, two of 60,000 kVA and three of 45,000 kVA capacity, arranged in each case in three single-phase units, together with two 15,000-kVA three-phase units, and the whole of the 132,000-volt switchgear for the seven main sub-stations of the western part of the section.

Fig. 1 shows a 15,000-kVA single-phase transformer of one of the 45,000-kVA groups and fig. 2 shows a group of three similar units removed from their tanks. The transformers are for step-up or step-down service; they have a voltage ratio of 20/132 kV and are arranged for delta-star connection. Large detachable radiators are fitted, so that with natural cooling the transformers will deliver 60 per cent. of their full rating, *i.e.*, 27,000 kVA in the case of the 45,000-kVA group illustrated. The radiators are bolted to the tank at the top and bottom and valves are provided in both connections, enabling the radiators to be detached for shipment without removing the oil from the tank body. Each transformer is also provided with an external air-blast oil-cooler, complete with fan and oil-circulating pump. The cooling plant will be brought into commission automatically by means of a temperature device on the transformer when the temperature exceeds a predetermined value, and will be automatically shut down when the temperature falls below that value.

On-load voltage-regulating gear is provided on each unit to give plus and minus 10 per cent. variation in steps of 1.43 per cent. The regulating gear can be seen in the foreground of fig. 1. It is of the contactor type, operating on tappings situated near the high-voltage neutral point of the transformer, which will be solidly and permanently earthed. A reactor, having a mid-point running position, is situated in its own tank below the contactor gear, and will be used to bridge the sections of the transformer winding while changing from one tapping to another, and also to obtain a mid-point running position between each pair of tappings, thus reducing the number of tappings and contactors required. The regulating gear and the reactor are mounted on a separate under carriage, which is bolted to the transformer tank, adjusting screws being provided underneath the regulating gear to facilitate lining up.

Two temperature indicators of the capillary type with dial indicators are provided on each transformer: one shows the oil temperature and the other shows the temperature of the winding. The latter device is fitted with two sets of contacts, one set operating lamp and "Klaxon" horn alarms in the event of the winding reaching a predetermined temperature, the other set being arranged to close the trip circuit of the oil switch in the event of the temperature increasing a further 10 deg. C.

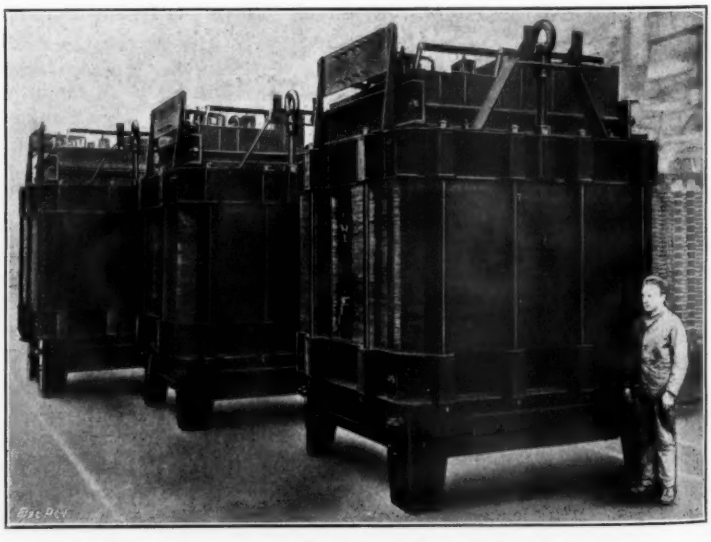


Fig. 2.—Group of Three 15,000-kVA Transformers Removed from their Tanks.

Accessories, including inspection covers, relief pipes,

oil conservators, filter valves, oil-sampling valves, drain valves, &c., are provided according to requirements on the various pieces of apparatus. The undercarriages of both the transformers and the regulating gear are fitted with rollers which can be turned through 90 deg. and locked in position, and are suitable for running on rails of the standard 4 ft. 8½ in. gauge in either direction.

One of the main problems that had to be solved in the design of these large transformers was that of keeping their dimensions within such limits that the transformers, in their tanks and complete with oil, could be accommodated for transport in railway trucks within the rather restricted loading gauge of the British railways. By co-operation between the engineers of the Central Electricity Board, the railway companies, and the transformer manufacturers, specially designed trucks have been evolved for the work of transport. Fig. 3 shows one of them, built by the London and North Eastern Railway Co., with two "Metrovick" single-phase transformers of a 60,000-kVA group loaded for dispatch to the Dalmarnock sub-station. The truck has detachable girder sides between which the transformers are slung and supported with their bases only a few inches above the level of the rail face. On arrival at the site the detachable side girders allow the truck to be taken apart and drawn away from the transformers, the latter being jacked up from the truck meanwhile and then moved sideways off the track. The truck is then reassembled and dispatched, the whole operation involving a minimum of delay.

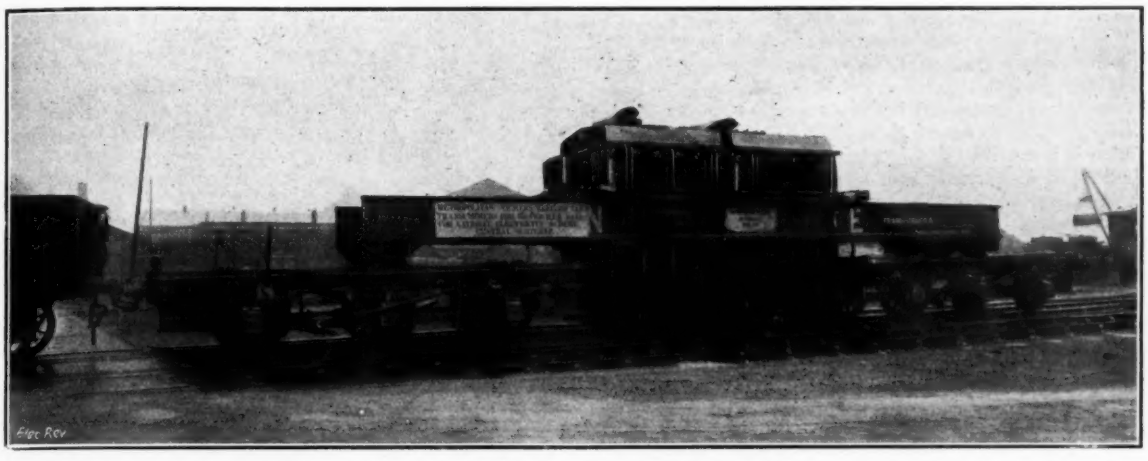


Fig. 3.—Two Single-phase Transformers Loaded on a Specially-designed L.N.E. Railway Truck.

An Old Problem—from a New Point of View.

It is suggested that by bringing all sources of technical education under one disinterested control, these, applied correctly and therefore used efficiently, would help a great deal to reduce unemployment in the future.

By RIC.

THE Institution of Electrical Engineers proposes to alter the conditions of membership and to revise the system according to which its members are classified. This seems to reveal another attempt to state more definitely still what a man should be and know before he can rightly call himself an engineer: "leaders" in the technical Press, also, recall a subject that has had, perhaps, too much written around it. But possibly one particular problem has attracted so little attention as to arouse useful interest still.

We may safely let the experts on education decide whether the straight college-and-works course, an inversion of it, or the so-called "sandwich" course is the best way of training those who can afford it. We grant that an engineering student should learn in a laboratory what a steam-gauge looks like and how it works: he should learn in a boiler-house not to trust blindly in a gauge when intuition tells him otherwise; and he should discover for himself in the shops how to work *with* men who are under his control, when that times comes. But, having assumed all this is true, what is to be done with the precocious youth who has only the usual supply of brains, no money at all, and an immovable determination to become an engineer? It is useless to tell him the idea is impossible, because he is likely to be of the age when we believe nothing is impossible: you dare not argue that a college training is absolutely necessary, because some of the greatest men have contrived to "get there" without that advantage, and he will remind you of it, believing firmly that he can do the same.

That is the problem; but, for a moment, consider something else that throws light upon it from a different angle. In England, at any rate, the usual method adopted when a firm seeks to fill a vacancy, is to advertise the post, giving very cursorily the nature of the work and delving very, very deeply into the past sins of the applicant. He is required to possess the B.Sc. degree or its equivalent, to have had at least two years' experience in a similar position, and to possess three testimonials. The type of man to whom the job most appeals is often one who is seeking just the experience the firm demands as a preliminary, and the need of which would make him keen, while testimonials will be difficult for him to obtain, unless those of the family lawyer and

Sunday-school teacher are included. But there is more in it than this. In far too many cases if the man who fits the advertisement does get the job, he finds that the only qualifications he needs are common-sense and the aptitude for " picking-up " things which should be a part of every would-be engineer's make-up. Once he is used to the firm's peculiarities and has got into the running of things he begins to feel that his job is too easy, not through conceit or over-confidence, but because it is so. He becomes discontented, naturally, and either slacks and does himself as much harm as he does his firm, or clears out at the first opportunity, to make way for another like him, and so it goes on. Is it not true that rarely indeed is the man with a science degree lucky enough to secure a job which is above him, and which is a continuation of his studies and not merely an exercise of his memory over a few things to the exclusion and ultimate loss of the greater part of the knowledge that cost him so much to acquire?

Presumably, those who advertise these posts either over-rate the value of them, or under-rate the possibilities in those who have not already proved their worth. The latter, after all, is reasonable: no employer can be expected to provide a free training-ground for an untried man who has not even an examination to show that he is capable of learning.

Now, we have come to the point from which the problem can be examined more clearly. While we by no means ignore the real advantages of a degree, nor attempt to bring it within reach of less fortunate students outside the college by making it easier to obtain—a worthless concession—while, too, we do our utmost for the universities and for those who work in them, may we not also attempt to weed out, from those who cannot enter by any known means of scholarship or grant, those who *will* be engineers at heart, however much we try to make them mechanics in the work they actually do? The universities will admit their failures; cannot those outside help to compensate for these by making a few successes?

At the present time the accepted alternative to college training is a course of evening classes. These institutions have been in existence for a long time and have enlarged their scope until they embrace, or are trying to embrace, the professions as well as cater for the trade. With the deliberate intention of calling forth all the evidence, for and against, which the experiences of teachers and students can give, I want to query whether this is being done in the wisest, most efficient way.

About a couple of years ago someone suggested during a discussion at the I.E.E. that these evening classes are over-reaching themselves; that they are attempting too much in trying to offer the equivalent of a day course, and should revert to their original plan and concentrate on the engineering trade. The same speaker stipulated that engineers should be college-trained; many will disagree, but most will accept these two points: first, that the same training, and method of training, will not serve both fitter and engineer; secondly, that both types of men are necessary to the community, and equally to be considered, for, although a prince may use a golden key when he opens a town-hall, the key must fit the lock. I suggest, then, that these institutions would do a far greater work were they to turn many of their lecture theatres into classrooms; extend their workshops, and produce good workmen, taught to be proud of what they can do with their hands and in nowise inferior or superior to those whose equal pride is in their directive abilities; at the same time opening their laboratories and offering a few specialised short courses of lectures *only* to those who have qualified themselves, by study, as keen to do the work and use those laboratories in the right way. For instance, if fitter's mates were taught that to become fitters is something worth doing and does not merely mean " picking up the tools " when the chance comes, and taught to treat their jobs as something above them, and not an insecure stepping-stone to that vague " something better " that steals away all thoughts of hard work in the present and leaves only dreams of an office and a " cushy " job in the future, a great end would be achieved. In the days of Michael Angelo the workers in stone were artists; today, the novice in engineering workmanship seems to be brought up as a speed-merchant. Give him, instead, for ambition the ability to work well, quickly if necessary, but at all costs well, and teach him *that* at evening classes.

All very nice; it is reasonable to suppose that if, each year, a certain number of lads are taught all they can learn about their job, and are then told to develop their experience, to always try to do their work a little better than it has been done before, and not expand their brains to understand what they will never apply, these people will become much more valuable as experts in a restricted sphere, than as smatterers who have not the faintest notion of the aim of half their studies and only an imperfect idea of how to do the simplest work; without a glimmering of light as to what they really are, only a sickly hope that somehow, somewhere, " something will turn up."

The solution of the rest of the problem seems so obvious that there must be a snag somewhere: it is hoped that someone will be tempted to reveal that snag, and be sufficiently interested to try to straighten it out.

An engineer must have a thorough grounding in about half-a-dozen subjects: mathematics, English, drawing, and others; and I seriously believe all but drawing can be taught, up to a certain stage, without the aid of a lecturer and the hindrance of overcrowded lecture rooms, the dragging effect of those who do not work on those who would, and the waste of time occupied in travelling. The thing can be done by private study, but—a tutor of some sort is necessary. A fellow of seventeen cannot see the boundaries of his job with the eyes of an experienced man and so decide what he should study, and how much he can profitably reject. Moreover, a student, however keen at the start, if left to himself is liable to work in furious spasms; to ignore the idea of system, and study only when he feels like it—and the temptation to work is quite easy to overcome. So that the problem is to find a tutor at reasonable cost, and to systemise a course of study which will not only lead to a worthwhile examination, but will qualify the student to attend evening classes of an advanced character (such that really do need a lecturer's personal contact) at the time when he is best able to appreciate and use them.

It is the easiest thing in the world to obtain a diploma, complete with a metal case to keep it in, from a correspondence school. There are, perhaps, four of these schools that attempt to carry out the promises in their advertisements, but they all fail in this respect, that the final examination, like those which precede it, is taken in the student's home, and such an examination is worthless as a recommendation to anyone who does not know him inside out. If you are known to be studying and one day turn up with such a diploma, you may secure promotion in your own firm, among your own crowd, but you cannot expect a stranger to accept such dubious evidence. He may like the look of you and wish to believe you earned that certificate honestly, but that is not enough: he must know or fail in his duty to his firm. To get over the difficulty, why not make the final examination in engineering (or any other course offered by the schools, if it comes to that) a public one? There seems to me absolutely no reason at all why such an examination should not be held, say, twice a year in a dozen centres, under an accepted examining body. Candidates would have to contribute towards the expenses, of course, but surely the cost of hiring a building, of stationery, and the examiner's charges could be covered by an examination fee, which need not be unreasonable and which the diploma would then make worth while?

This would mean the co-operation of the leading correspondence schools with representatives of the engineering institutions to form a central Board of Technical Education, and it would be the work of this body to produce a scheme under which the various schools, while continuing with their individual methods of teaching, provided the Board accepted these, would, under its control, then co-operate instead of compete, as at present. Apart from test-papers set at their own discretion, the schools would set no examinations and would not be

permitted to offer diplomas. That would be solely the business of this Advisory Board, which, by taking over the responsibility for the subjects studied by candidates, and by offering them a public examination accepted by the people in the profession who really matter—employers and engineers—would, at least, remove the stigma which is at present attached to "tuition by post."

Without doubt, these problems do require an immediate solution. We need skilled, clever workmen who are not ashamed of the fact; we do need skilled, clever engineers. But, above all, employers in particular want some means of recognising the "goods" when they are put before them to avoid accepting, in their stead, half-keen, easily satisfied men who merely seek an opportunity to "settle down" into a fairly comfortable post, doing in a mediocre, or frankly bad, manner, what they have neither brain nor energy to do well. At present, the employers' sole safeguard is to demand a high examination, and experience, for nearly every little vacancy that occurs. That again, as I have already suggested, gives the same result, because such a man, tied to a job that is far beneath him, is not encouraged, or even enabled, to show his abilities. We need, as well, to cut down the large percentage of would-be engineers who will never stick it long enough to "arrive," and to do that we must go right to the root of the matter. It cannot be done while many and various institutions of the correspondence type offer cheap, and easily acquired, education, and place fast promotion and lucrative posts before the eyes of uninitiated "fond parents." Success cannot be attained that way: moreover, the profession needs, not men of that type, but those who are prepared to win dearly every step of the way and who will consider, within reason, the services they can render, before the personal ends they hope to achieve.

All the above is admittedly but a brief lightning sketch of an idea: even on paper it seems so simple that to go into details at such a stage would be ridiculous. But it is suggested that any scheme which attempts to solve a problem such as this, at times such as these, is worthy of criticism.

Rectifier Instruments for A.C.

An Account of the Application of Copper-oxide Rectifiers to Moving Instruments.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P. (Chief Instrument Designer, Messrs. Ferranti, Ltd.).

THE d.c. moving-coil measuring instrument can be made to give full-scale deflection for a smaller consumption of power than can any comparable type, the electrostatic voltmeter being excluded. It is easily possible to produce suspended-coil instruments of moderate resistance requiring much less than a micro-ampere for full-scale deflection, and even with double pivots microammeters are practicable.

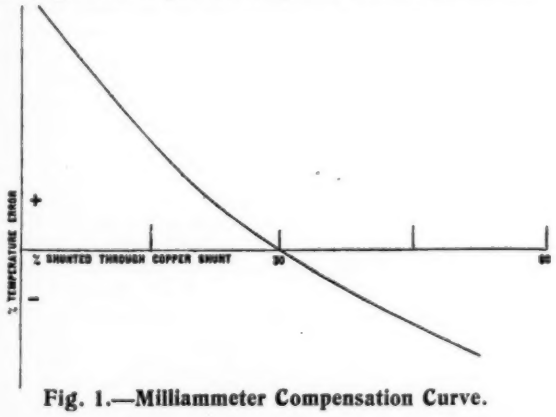


Fig. 1.—Milliammeter Compensation Curve.

The sensitive moving-coil instruments have been applied to a.c. measurements in two distinct forms. One uses a thermo-junction, which may actually be a part of the movement, such as the Boys' radiomicrometer, and the later Duddell thermogalvanometer, or externally by means of separate vacuum, or air, thermo-junctions. In this case the low range of a.c. is possible only by using a sensitive, and usually delicate, instrument. When using robust switchboard instruments the lowest range is usually an appreciable fraction of an ampere. The other method is to use one, two, or four rectifiers with the moving-coil instrument, so that although a.c. exists in the line, only a rectified current passes through the instrument, which is necessary on account of the type of instrument.

The simplest, and one of the earliest, forms of rectifier used with an instrument is a crystal, such as was used for wireless-signal rectification some years ago. In general it gave some comparative indication, although it was not usually stable enough to withstand any movement, and could not maintain its calibration for more than very short periods.

The thermionic valve which displaced the crystal for wireless rectification also displaced the crystal for instrument use, and as the constants of a valve are much more lasting and definite, it was quite easy to calibrate such an instrument and to obtain reasonable accuracy when the valve was made to function under given conditions. A.c. instruments utilising moving-coil movements and thermionic valve rectifiers are usually assembled and calibrated as required, as they are somewhat bulky on account of their associated batteries; they are not usually built up and supplied as complete instruments, entirely owing to the non-portability of the

Fig. 2.—Microammeter for Telephone Work.

rectifying unit. Notes on the use of valve rectifiers with instruments have been published from time to time.*

The copper-oxide rectifier introduced by the Westinghouse Brake & Saxby Signal Co., Ltd., some few years ago has met the demand for a small self-contained, portable, and reasonably constant rectifier; a detailed paper on the characteristics of this rectifier has been published by L. O. Grondahl and P. H. Geiger.†.

Messrs. Ferranti, Ltd., realised its possibilities, and some years ago commenced experimental work with a view to its inclusion in an instrument, particularly for a series of 2½-in. dial movements, in which case the moving-iron instrument, the only practicable alternative, is not as satisfactory as can be desired in so far as energy consumption and applicability to very low ranges are concerned. Considerable experimental work,

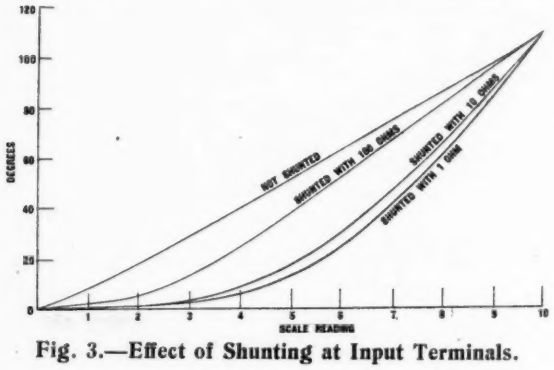


Fig. 3.—Effect of Shunting at Input Terminals.

some of which is outlined below, has resulted, and it has been found that it is possible to make a satisfactory a.c. instrument with the aid of a copper-oxide rectifier, with certain limitations.

The desiderata for a satisfactory rectifier are (1) high ratio of "reverse" to "forward" resistance, (2) a linear characteristic, (3) constancy with time, (4) constancy with varying temperature, and such numerous minor requirements as robustness and portability, overload capacity, and independence of frequency and wave form. The copper-oxide rectifier possesses them to a greater or lesser extent, the results being as follows:—

(1) *and* (2) *Resistance and Characteristics.*—Under the best conditions the reverse resistance may be as much as one thousand times the forward resistance, but the second consideration (linearity of characteristic) has to be considered. A conductor obeying Ohm's law has a linear characteristic, or the current is proportional to the voltage, but the copper-oxide rectifier does not obey Ohm's law, as its characteristic is curved, and although in certain circumstances this is a useful feature, it is in general a drawback to its use in measuring instruments. It is manifest in the scale shape, which, instead of being truly linear like that of the ideal moving-coil movement, is somewhat contracted at the beginning. The contraction is not consistent with all ranges, and in the case of high-range voltmeters and milliammeters is nearly absent, with the result that the scale becomes very nearly linear. Whilst considering the ratio of reverse to forward resistance, it is necessary to decide how many rectifier elements are to be used. If one only is used, the circuit will be broken, in effect, every half cycle, so that one is only applicable to voltmeters. With two elements, the measuring instrument being in series with one, a circuit can be maintained throughout, and the voltage across the rectifier will be limited by the resistance of the movement, but it is only possible to connect the instrument in one side. Provided that the supply is symmetrical about the zero axis, which implies no d.c. component, multiplying the reading (in r.m.s. value) by 2 will give the total line current, but if the wave form is not symmetrical about the zero axis, instruments connected in series with each rectifier will not read similarly. This fact is often of use, but for straightforward measuring circuits when the r.m.s. value of current or voltage is required four rectifier elements are necessary. In this instance the true r.m.s. calibration is not obtained directly from the d.c. reading and an assumed form factor (which, for sinusoidal waves, equals 1.11) on account of the considerations (1) and (2) above. If, however, the calibration is performed with a.c., using true r.m.s. instruments for comparison, a correct scale will be obtained, for the particular wave form used.

In practice, if such an instrument is tested with a true mean voltmeter (say, of the thermionic, or mechanical rectifier, types) mean readings are obtained in very close agreement, thus showing that if calibrated in r.m.s. units the instrument is dependent on wave form. As, however, modern supplies are all very nearly sinusoidal, no serious discrepancies are found between readings on different supply mains, but if a small saturated transformer, or other apparatus which distorts the wave-form, be used, the readings obtained will not be true r.m.s. readings.

(3) *Constancy with Time.*—It is yet too early to state finally if this form of rectifier is really permanent in its characteristics. Rectifier instruments have been under observation for some years, and with the designs that have been adopted they have been found sufficiently reliable to justify them being placed on the market. A period of very many years must elapse, however, before it will be possible to state the probable reliable life of such a rectifier, and at present it can be considered to be quite satisfactory if properly made up and calibrated initially, and not subjected to serious overloads, or very high temperatures; it is essential that the rectifier elements should not be dismantled after calibration.

(4) *Constancy with Temperature.*—The resistance per disk of a copper-oxide rectifier varies appreciably with temperature, decreasing as the temperature increases. As the resistance, either forward (the low-resistance direction) or reverse, varies with the current passing, so will the temperature effect vary too; in general the higher the current the smaller the change due to temperature. In the forward direction the curves connecting resistance with temperature are very approximately linear, but those for the reverse direction are decidedly not linear, and have usually two points of inflexion, giving a definite maximum and minimum on each curve, which fact shows that the temperature effect is by no means negligible and needs compensation. A plain uncompensated rectifier instrument will be in error, depending in each case on the range and size of rectifier, up to as much as, or more than, 0.5 per cent. per deg. C. Such an error is intolerable, and a suitable means of compensation has had to be sought; in general the type of compensation required depends on whether the instrument is a voltmeter or a milliammeter. The latter, when correctly compensated, still varies in impedance with temperature, and so a varying voltage drop results which, in the case of a milliammeter, is of no consequence, but in that of a voltmeter is still unsatisfactory. When the voltage range is high and the applied voltage is mainly across the series resistance, the rectifier error is swamped entirely, but for ranges below about 10 volts this is not the case, and the compensation required depends on each individual range; in some cases the error is not quite negligible, but of the order of 0.1 per cent. per deg. C.

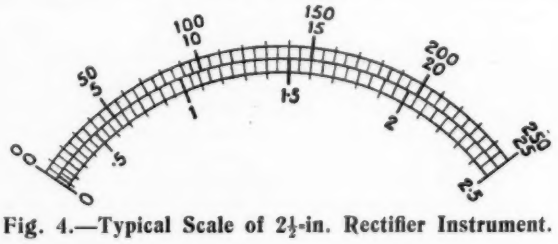


Fig. 4.—Typical Scale of 2½-in. Rectifier Instrument.

* "Measuring Small Alternating Currents," *Electrician*, August 20th, 1926, p. 202.

† "A New Electronic Rectifier," *Journal A.I.E.E.*, Vol. XLVI, No. 3, pp. 215-222.

Milliammeter compensation consists in applying a copper shunt across the a.c. terminals of the rectifier network, so that less current is shunted as the temperature rises. Fig. 1 shows the type of curve which is obtained, and it will be apparent that when about 30 per cent. of the line current passes through the shunt, at calibration temperature, the error will be negligible, and that by increasing the shunted current the sign of the error can even be reversed. Such shunting increases the current consumption somewhat, so that with a particular movement requiring 5 milliamperes d.c. for full-scale deflection, the line current being more than this on account of the form factor, the total line current, including both rectified and shunted, becomes about 7.5 milliamperes; this value is actually used in some voltmeters. With other movements a factor of 1.5 still holds, so that the resistance in ohms per volt can be stated for any given design of movement. The curve shown is not general, but is typical of a particular movement only; others give curves of similar shape, but of altered values.

Frequency.—There seems to be no reason why rectifier characteristics should alter with frequency, except at extreme limits, which is in general the case. The d.c. reading of a rectifier instrument is definitely not the same as the r.m.s. calibration; hence it may be said that at zero frequency the error is appreciable. Similarly, at radio frequencies the reading is useless, as the capacitance between the disks of the rectifier is such that practically all the current is shunted straight through the rectifier. Ferranti instruments have over the power-frequency range of 25-100 cycles no readable error, and at telephonic frequencies their error is still small; at a frequency of about 6,000 cycles it is difficult to be sure of any current readings to within a fraction of one per cent., but, so far as various and independent tests have shown, the error is then still within two per cent.

Impedance.—The impedance of a milliammeter varies with the scale reading, and is due to a change of capacitance with reading, as well as with frequency, which is approximately linear, and a change of resistance with both reading and frequency, resulting in a decrease of impedance with reading and an increase with frequency. As variation of the impedance of a milliammeter is usually of no account and voltmeters are sufficiently swamped by the series resistance, this is by no means the undesirable feature that is presented at first sight. This fact is of enormous importance, as, in addition to the use of this type of instrument for power work, where there is usually sufficient power to operate a moving-iron instrument, it is also suitable for telephone work in which small currents are usual and the available power very small also. The instrument illustrated in fig. 2 has numerous applications to telephone investigations, as it will actually follow the fluctuations of speech current passing through a telephone receiver.

Shunting for Higher Ranges.—A shunt across the input terminals distorts the scale shape from an approximately linear to an approximately parabolic form as the proportion of shunted current increases (fig. 3), which is serious, and so plain shunts across the a.c. terminals of the instrument do not find much application. There is no reason why there should not be a shunt across the d.c. movement, however, and so current ranges up to the limit of the rectifiers are possible, with nearly linear scales. In the case of the 2½-in. instruments mentioned at the commencement of this article, it is only possible to accommodate a small (60 milliampere) rectifier, so that the maximum range used is 50 milliamperes). Ammeters are then only possible with current transformers, but there are two important differences between such transformers and those usual for moving iron instruments. The secondary current has to be 50 milliamperes, or less, instead of 5 amperes, and the volt-ampere consumption is considerably reduced, owing to the presence of the permanent magnet. With this exception (small volt-ampere consumption) the scope of rectifier ammeters and milliammeters is definitely for low ranges, where the resistance of a moving-iron instrument is prohibitively high.

The following figures of volt-ampere consumption, as they vary with different movements, merely give an idea of the general magnitude, which is definitely lower than corresponding figures for moving-iron or dynamometer types:—

2½-in. dial, 1 mA movement, uncompensated, 0.0004 VA, a.c.

4-in. dial, 5 mA movement, uncompensated, 0.0035 VA, a.c.

Wave-form error is about the most serious limitation of this type of instrument, as has been detailed above. Any number of ranges of a.c. may be incorporated in an instrument: ranges of above 10 volts follow the same law, so that two ranges of, say, 10 and 100, or 25 and 250, volts will be accommodated on one scale by a multiplying factor. Below about 10 volts individual scales are necessary, so that for those ranges the total number is limited to the number of scales that can be drawn on the instrument dial; two, or at the most three, is the maximum. Fig. 4 shows a typical scale of a 2½-in. self contained rectifier instrument for 2.5, 25 and 250 volts, alternating current.

A voltmeter-ammeter test set is possible when compactness is the first consideration, using a movement of a few milliamperes with series resistances for the voltmeter and a multi-range transformer for the current readings.

Acknowledgment with thanks is made to Messrs. Ferranti, Ltd., for permission to publish the information referring to their instruments.

School . Lighting.

Some notes on a subject that does not as a rule receive the attention it deserves, considering its influence on defective vision.

By H. E. HUGHES.

JUDGING by the active interest that is being taken to-day in the correct lighting of schools, it would appear that there is every reason to hope that this previously neglected branch of the art of illumination will be receiving much more attention in the immediate future, and that modern lighting installations will become the rule rather than the exception. Inadequate lighting in schools, it has been proved, has been the cause of a great deal of eye trouble amongst the children, and this becomes plainly evident when it is realised that very few children are born with defective vision, yet an increasing percentage, with increase in age, have disabilities of this kind.

In the London schools it has been found that only 3 per cent. of children under six years of age have seriously defective vision, but that 11 per cent. of those over eleven years of age showed bad defects, and in subsequent years this percentage steadily increased. We are not perhaps in this country in such an unfortunate position as in some Continental towns, where in bad cases as many as

60 or 70 per cent. of the pupils have defective vision.

An interesting point in this connection is the fact that while there is always a general increase in the acuity of vision with increased illumination intensities, it has been proved experimentally that those children most affected by the improvement are the sufferers from astigmatism and other defects. Conversely, bad lighting is more of a disadvantage, in proportion, to those that have already poor visual powers, and there are other influences to be considered; for example, children who cannot see easily soon acquire the habit of stooping, and cramped positions due to improperly placed lights even lead to such ill-effects as curvature of the spine.

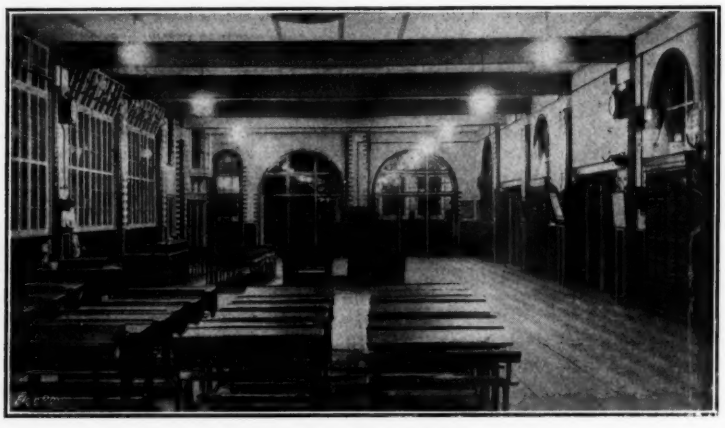


Fig. 1.—An Assembly Hall at West Ham.

The seriousness of this matter of school lighting has only recently commenced to dawn on the public conscience and to be investigated by specialists. The cost of providing good lighting, it would almost seem, is the chief factor in the minds of those responsible, though there are naturally other considerations that have some weight. In this connection it is interesting to note that at a recent meeting of the Education Committee of the London County Council, it was reported, on the one hand, that the cost of electric lighting at present prices was about the same as the cost of gas lighting. The cost of installing electric lighting, on the other hand, was usually much greater than that of modernising existing gas services and providing the latest type of super-heated inverted gas burners. To offset this, however, it was anticipated that the facility with which electric lighting can be turned on and off would tend towards economy, and that the cost of energy and maintenance would be less.

The Sub-Committee considered that the benefits to be derived from electric lighting, such as increased cleanliness, convenience, and improved health conditions, justified electric lighting wherever it could be installed economically in new and remodelled schools. Fig. 1 shows an assembly hall in a West Ham elementary school, equipped with "Holophane" No. 2120 reflector refractors and 100-watt gasfilled lamps; fig. 3 is a view of a class room in the same school, equipped with No. 2110 reflectors and 60-watt lamps; while fig. 2 shows the gymnasium at the Latymer school, Edmonton, wherein F150 reflectors and 150-watt lamps are used.

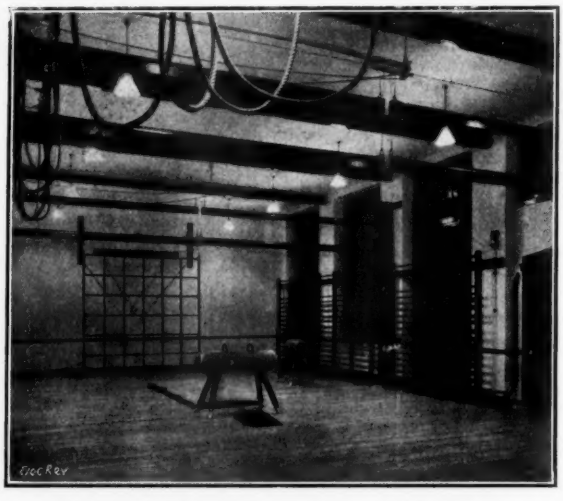


Fig. 2.—A School Gymnasium at Edmonton.

Another interesting and instructive reference to the same subject was made at a recent meeting of the Illuminating Engineering Society by Mr. H. T. Tizzard, C.B., F.R.S., secretary of the Department of Scientific and Industrial Research. His attention had recently been directed to the problem of school lighting, and from a conversation with an ophthalmologist he gathered that inadequate lighting was one reason for the tendency towards the deterioration of vision during school life. He said he had interested himself in the lighting of a school where special efforts had been made to ensure the correct placing of light sources with regard to the desks and blackboard, for the purpose of eliminating conditions that might cause eyestrain. The results of his efforts were quite encouraging, and, so far, there was no evidence of further deterioration of the eyesight of the pupils.

At the Merchant Taylors School, Charterhouse Square, the great hall, which at one time was lit by gasoliers, is now served by diffused electric lighting. This is effected by a number of unobtrusive bronze octagonal units with white rippled glare-eliminating glassware. Each unit is installed some 30 ft. above the desks, and is equipped with a special form of silvered-glass distributing reflector which permits of the light emitted from 200-watt lamps being directed downwards, so as to provide ample light without shadow or glare.

In producing the successful scheme referred to, the General Electric Co., Ltd., collaborated with Messrs. Maxwell Butcher & Co., Ltd., the electrical contractors responsible for the scheme.

Fig. 3.—An Elementary School Class Room.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Marking of Imported Glassware.

A Board of Trade Committee under the Merchandise Marks Act, 1926, began an inquiry last week into an application for the marking with an indication of origin of: Domestic, fancy, and illuminating blown glassware of all descriptions (other than electric lamp bulbs); pressed glassware of all descriptions; and bottles, jars, and other containers of glass. The original application included lamp-blown ware and scientific glassware of all descriptions, including tubing and rod, but this is to be considered as a separate application. The applicants were the Glass Manufacturers' Federation, the British Flint Glass Manufacturers' Association, and the Northern Association of Pressed Glass Manufacturers, supported by other trade associations and the trade unions concerned, as well as a number of individual firms.

Mr. Wethered appeared for the applicants. The principal opponents were the China and Glassware Section of the London Chamber of Commerce and some groups of British manufacturers. Mr. Wethered, for the appellants, dealing with domestic, fancy, and illuminating blown glassware—other than electric lamp bulbs—said that imports of that class had increased from £1,768,985 in 1921 to £2,247,939 in 1927, and it was complained that foreign makers had copied British designs and trade names so that it was practically impossible for anyone to distinguish the foreign from the British. Foreign articles were often mixed with British articles and sold at prices equal to the best English glass; there was no doubt that many purchasers bought foreign glass under the impression that they were buying English ware. It was suggested that an indication of origin could be given by means of an acid transfer or sand blasting; indeed, some British firms had been doing that for years. The cost would be exceedingly small. British firms made 25 per cent. of the lighting glass required in this country. Answering the chairman, Mr. Wethered said that lighting glassware included shades for electroliers and chandeliers, glass globes for gas or electric lighting, bowls, lamp chimneys, and any form of glassware used for lighting purposes.

Some evidence was given on April 30th with regard to illuminating glassware. Cross-examining one witness, Mr Macaskie (for the opponents) suggested that if a globe or shade were prominently marked, the impression would be given that the whole fitting was foreign, but the witness did not agree. Another witness objected to the use of adhesive labels which were too easily removed; he said that permanent marking should be employed.

The Chloride Electrical Storage Co., Ltd., has lodged an objection to the marking of glass bottles, jars, and containers It maintains that it finds it difficult to obtain suitable accumulator containers from British manufacturers, and therefore imports them. If the foreign containers were marked to indicate their origin, there would be a grave danger that the marking would be taken to apply to the whole of the accumulator.

At the resumption of the hearing on Monday last and on succeeding days evidence of a general nature, for and against marking, was given by a number of prominent glass manufacturers and buyers.

General Rise in Australian Wages.

Owing to a sharp rise in the cost-of-living figures in Australia during the first quarter of this year there have been large increases in the basic wages in various States. As a result it is calculated that the Victorian Government Railways will have to pay £200,000 per annum more in wages, while the Melbourne Tramways' wages bill will rise by £30,000.

An ex-Siemens Association.

At an enthusiastic meeting held at the Hotel Cecil on April 27th it was decided to form an Association of Ex-Siemens' Men, and a portion of the committee and the officers were elected. The qualification for membership is that applicants should be ex-members of the Siemens' organisation who have served at least one year on the staff. A dinner is to be held at the Hotel Cecil on Wednesday, May 29th, and it is hoped that there will be a good muster. Mr. J Snow Huddleston has been appointed hon. secretary and treasurer, and will be pleased to forward full particulars of the Association and also of the dinner to any intending members. Inquiries should be addressed to the hon. secretary, c/o The Union Cable Co., Ltd., Dagenham Dock, Essex.

"The Eight Markets of the World."

This is the sub-title of a "salemanship" article which appeared in last week's *Times Trade and Engineering* Supplement, and it is designed to remind British firms that the world market is not a single entity with the same characteristics throughout. There are really a number of quite distinct markets, each with its individuality, which can conveniently be classified under eight heads:—Western Europe; the Near East, including Eastern Europe, Asia Minor and the north coast of Africa; Africa, roughly south of the Equator; India, Burma, the Malay States, the East Indies and Afghanistan; Eastern Asia; Australia and New Zealand; Canada and the United States; and Central and South America, and the West Indies. Several important British firms have already divided up the world into these or similar areas and as a result their sales organisations have been simplified, costs have been reduced, and sales increased. Each district is under the control of a sales supervisor who is responsible to headquarters for the sales throughout his district, and each district is of such a size that he can visit each branch or agency at least twice a year if necessary. The interests of the districts are looked after at headquarters by eight district advisory managers who work in close co-operation with the district sales supervisors; indeed, it would probably be a good thing if the two changed places every two years, thus ensuring that each is up to date in his knowledge of affairs both at home and in his district.

A Hire-purchase Financing Company.

The United Dominions Trust, Ltd., a banking concern which specialises in hire-purchase transactions, has sent us an illustrated brochure outlining its ten years' history. It has made tremendous progress, which may, perhaps, be looked upon as an index to the growth of the hire-purchase system in this country. The booklet sets out the various classes of trade for which the Trust caters, special reference being made to the engineering, electrical and allied industries.

United States Electrical Exports.

The total value of electrical machinery and equipment exported by the United States during February last was $10,625,444, as compared with $7,891,786 in the corresponding month of 1928. The increase was general, but the following items made notable advances:—Radio apparatus from $563,352 to $1,120,309; refrigerators up to one-ton capacity from $368,513 to $598,542; insulated copper wire and cable from $368,918 to $605,897; bare copper wire from $190,753 to $385,376; stationary motors from $193,919 to $349,374; vacuum cleaners from $68,785 to $135,217; sparking plugs from $75,958 to $259,472; and unspecified apparatus from $557,970 to $904,545. There were very few important decreases: a.c. motors fell from $51,957 to $8,920; telephone apparatus from $432,556 to $363,132; and furnace electrodes from $231,316 to $167,145. Canada, as usual the principal market, took American goods valued at $2,826,498. The United Kingdom ($775,857) was second, and Argentina ($636,814) third. Other leading customers were:—Australia ($519,974), Brazil ($464,776), Italy ($407,079), and Mexico ($401,740). United States electrical imports during February had a value of only $163,555.

Electric Pumps for Brazil.

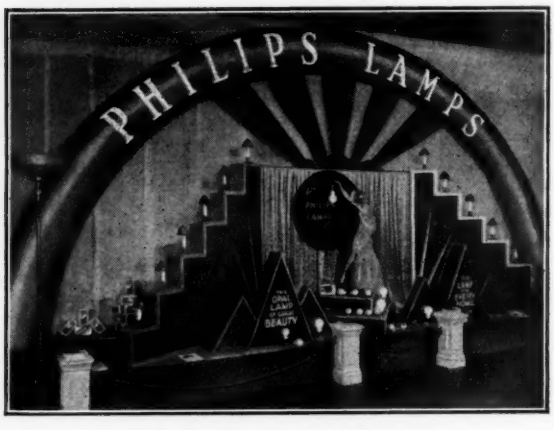
A brief confidential report on the market for electrically-driven water pumps in Brazil has been prepared by the Department of Overseas Trade from information forwarded by the Commercial Secretary at Rio de Janeiro (Mr. Stanley G. Irving). United Kingdom firms desirous of receiving a copy of this report should communicate with the D.O.T. 35, Old Queen Street, London, S.W.1. (Reference A.X. 7886.)

Unemployment.

The registers of the Employment Exchanges at April 22nd showed a decrease of 12,840 in the number of unemployed during the week. At that date the total was 1,140,700, as compared with 1,153,540 on April 15th and 1,062,285 on April 23rd, 1928.

A Philips' Lamp Display.

The picture which accompanies this note shows one of the windows of the premises of Messrs. Lewis's, Ltd., Liverpool, as arranged by the display staff of Philips Lamps, Ltd. It is an example of the effectiveness of simplicity, no effort being



A Philips Display at Liverpool.

needed to take in the whole of the window and its message at a glance. The most striking feature is the "rainbow" in natural colours which arches over the display.

Estonian Electrical Imports and Exports.

During February last the imports into Estonia of electrical machines, apparatus and implements were valued at 187,730 kr. (about £10,000), while exports of the same class were valued at 14,041 kr. (£770).

Price Reductions.

The Edison Swan Electric Co., Ltd., announces reductions in the prices of its vacuum grid leaks and anode resistances.

Book Notices.

"The Henley Telegraph," Vol. III, No. 24 (56 pp.). London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net.—The latest number of this well-produced house organ includes some notes on the origin of the company, a report of the annual staff dinner, and a sketch of the career of Mr. P. Dunsheath, O.B.E., who has been appointed Research and Technical Manager to the company, as well as other illustrated articles and notes.

"Some Notes on the Stroboscope; with particular reference to the Ashdown 'Rotoscope.'" (Pp. 48, 21 figs.). Published by A. J. Ashdown, Ltd., 119, Victoria Street, S.W.1. Price 1s. 6d.—A number of prominent engineers have assisted in the compilation of this brochure, which explains the principles and construction of stroboscopes and the company's "Rotoscope." The many applications of the apparatus are dealt with in an interesting way.

"Kempe's Engineer's Year Book for 1929." Pp. lxxvii+3289. London: Crosby, Lockwood & Son. Price 30s. net.

"Bulletin of the British Cast Iron Research Association." No. 24. April, 1929.

Babcock & Wilcox in Spain.

A message from Bilbao says that the Compañía Euskalduna and Babcock & Wilcox are negotiating for the joint erection of a works near Bilbao for the manufacture of Diesel-electric engines and accessory material, chiefly for the railways.—*Reuter's Trade Service* (Madrid).

Income Tax and Hire Purchase.

Upon representations from the Hire Traders' Protection Association the Commissioners of Inland Revenue have approved an optional alternative method of computing the assessable profits of hire-purchase traders. This involves the treatment in accounts of unpaid balances under hire-purchase agreements as "Stock out under hire-purchase agreements," such stock to be valued by deducting from the outstanding balances the proportion of gross profit included therein. It is not proposed that the method shall be applied to each individual transaction, but that the whole of the hire-purchase business of a trader shall be considered and an average percentage of gross profit employed for calculation purposes. The Commissioners' decision, in effect, is that in future they will not treat hire-purchase contracts as actual sales on instalments, but as the hiring of articles, which does not involve the payment of income tax when the agreement is signed, the tax being spread over the period of hiring. Further details of the scheme can be obtained from the Secretary of the Association, 27, Chancery Lane, W.C.2.

Recent Contracts.

The Electric Furnace Co., Ltd., has recently received a number of orders for furnaces in foreign countries, in some cases in spite of heavy import duties. These include two Héroult furnaces for India and Brazil, four Ajax-Wyatt furnaces, each of 600 lb. capacity, and four Ajax-Northrup high-frequency furnaces, varying from 15 cwt. to 2 cwt. capacity, for France. The company will also shortly be putting into operation a one-ton Ajax-Northrup furnace in France. This furnace, of which the output is equivalent to a four-ton arc furnace or an eight-ton open-hearth furnace, is claimed to be the largest h.f. furnace yet constructed, and has been designed and built in Great Britain. The company will shortly be starting three 5-cwt. Ajax-Northrup furnaces in France, which were ordered last year.

Among the orders recently received by the Airedale Electrical & Mfg. Co., Ltd., are a year's contract from Liverpool Corporation for air- and oil-break motor starters; Marconi's Wireless Telegraph Co., Ltd., special control panel; South African Railways and Harbours Board (per Messrs. Rice and Diethelm, Ltd., Johannesburg), six-panel unit type ironclad l.p. switchboard.

The Iron & Nickel Battery Co., Ltd., informs us that "Ionic" batteries have been supplied for emergency lighting in the *Ulster Monarch*, *Ulster Queen*, and the *Ulster Prince*. The *Ulster Monarch* is the first oil-engined passenger vessel to be placed in service on the Liverpool-Belfast route.

Messrs. Darwins, Ltd., Sheffield, have received an order from the Philips Co., Eindhoven, Holland, for magnet steel valued at £100,000.

Cardiff Corporation has placed a further order with the Equipment & Engineering Co., Ltd., for two miles of phono-electric trolley wire. The company has also received another order from the Manchester Corporation Tramways for an "E.L.1," two-operator welding plant.

The Radio Wholesalers' Federation.

At a meeting of the new Council of the Radio Wholesalers' Federation on May 1st, Messrs. C. H. G. Hobday (Hobday Bros., Ltd.) and W. A. Hunt (London Electric Stores, Ltd.), were co-opted members. The officers for the year were elected as follows:—Chairman, Mr. E. W. Houghton (Houghton-Butcher (G.B.), Ltd.); vice-chairman, Mr. B. R. Banks (Brown Bros., Ltd.); hon. treasurer, Mr. A. G. Beaver (Sun Electrical Co., Ltd.). The above gentlemen, with Mr. T. Beadle (T. Beadle & Co., Ltd.), again constitute the Federation's Liaison Committee.

New London Showrooms.

Messrs. Best & Lloyd's new offices and showrooms in Great Marlborough Street, W., are noteworthy for the attractive front (illustrated herewith). The colour scheme is black and red, well calculated to set off the fittings, and the lights in the window. The architect was Mr. V. O. Rees. The advent of such firms into the heart of the West End may be taken as a sign of the growing importance of the electrical trade. Among the many articles shown are "Firelight" glass

Messrs. Best & Lloyd's New London Showrooms.

fittings, and the "Rippleray" electric fire. These are only two examples of modern well-designed fittings to be seen at the new premises. Recent lighting contracts carried out by Best & Lloyd include the Royal Horticultural Hall, Westminster; the Co-operative Permanent Building Society's new headquarters in London; the Ritz Palais de Danse, Manchester; and the Manchester Ship Canal offices.

Trade Announcements.

In addition to existing branches in London, Birmingham, Bristol, Dublin, Glasgow, Manchester, and South Wales, Messrs. BLACKSTONE & CO., LTD., have opened a further branch at Groat House, Collingwood Street, Newcastle-on-Tyne.

Messrs. T. BEADLE & CO., LTD., Hull, in addition to their branches at Grimsby, Leicester and Liverpool, have now opened a branch at 96, Hamilton Street, Birkenhead, for the sale to the trade only of radio and electrical material.

The Ipswich branch of the GENERAL ELECTRIC CO., LTD., is being moved, as from May 13th, to larger premises in Westgate Chambers, 40b, Westgate Street, Ipswich. The telephone number and telegraphic address will remain as at present, *viz.*: Ipswich 2379 and "Electricity, Ipswich."

Mr. G. J. PAYNE has been appointed London sales manager of the Electrical Power Engineering Co. (Birmingham), Ltd. His offices are at Fetter House, Fetter Lane, E.C.4.

Messrs. ALBERT E. SUDLOW & Co. have removed to new premises at 60, George Street, Manchester.

Glasgow and a German Tender.

At its meeting on May 1st the Glasgow Tramways Committee decided to recommend the Corporation to accept a tender for copper trolley wire submitted by Messrs. Dennis & Co. for material made by Felten & Guilleaume, Germany. An amendment that the order should be divided between two British companies was rejected. It was stated that the price tendered for the German wire was £1,260, and the lowest British offer £1,372.

German Foreign Electrical Trade.

The exports of electrical plant, apparatus, and fittings from Germany attained a value during January last of £2,518,850, as compared with £1,864,950 in the corresponding month of 1928. The German imports of similar material advanced from £176,600 to £229,300.

Cycle Traders as Electrical Retailers.

In the course of a recent article on "Electrical Fittings as Selling Lines" a writer in the *Motor Cycle and Cycle Trader* urges that "the cycle dealer who is on the look out for additional means of augmenting his income would do well to consider selling electrical fittings in his own district."

A New Cable Works at Derby.

In our "New Companies" section particulars are given of Derby Cables, Ltd., which is being formed with a capital of £100,000. A factory of considerable size is being built for the company in Alfreton Road, Derby, for the manufacture of electric cables. The directors are: Mr. C. A. Newton, A.M.I.E.E. (chairman), Mr. J. H. Lord, Lt.-Col. H. Newton, C.B.E., D.S.O., Mr. H. B. Potter, and Mr. F. Newton (managing director). Mr. H. E. Sewell, who until recently was works manager for the Macintosh Cable Co., is the general manager. The directorate is practically the same as that of Haslam and Newton, Ltd., who hold a controlling interest in the new company. The factory is progressing rapidly, and will be equipped with the latest type of plant for the production of paper-insulated and armoured cable, all types of v.i.r. cables, compound-insulated cables of all types, mains, shaft and trailing cables for collieries, dynamo and other flexible cables and cords, switchboard cables, railway signal cables, and ship wiring cables.

Bankruptcy Proceedings.

L. N. BENNETT, 113, Croydon Road, Caterham Valley, late of Herne Bay, radio engineer.—The receiving order herein was made on the debtor's own petition, and, according to the statement of affairs filed, there are liabilities of £315 and no assets. The debtor attributes his position to the failure of a company to discharge his liabilities under an agreement. He traded with another from August, 1924, until June, 1926, as "The Efficiency Wireless Service." The partner retired, and received £225, part of which the debtor had borrowed, for his outgoing interest. The debtor carried on alone until July, 1927, when he transferred the concern to a company which he registered, with a nominal capital of £100. The company acquired his assets, estimated at about £300, and agreed to discharge his liabilities amounting to about £250, and the debtor received as consideration 99 fully paid £1 shares, and was appointed a director. Heavy losses were incurred, and the company has been unable to discharge his liabilities. In June, 1928, the debtor resigned his directorship and disposed of his shares for £400, which he immediately lent to the company, and now regards as a bad debt. At the first meeting of creditors the case remained in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Court Bros.	35	Reynolds, D. ...	160
Latimer, H. H.	63	Hobday Bros., Ltd. ...	28

W. R. BALL and J. H. LEACH, trading as R. Ball & Co., electrical engineers, 187, Upper Street, Islington.—This firm failed in March, 1925, and on April 30th the debtor Ball applied to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge. The Official Receiver reported that the liabilities amounted to £2,389, and the assets had realised £20. The applicant began business in January, 1922, with £100 capital as an electrical and mechanical engineer, and in March, 1923, was joined by Leach, who provided cash £100 and machinery £100 in return for a one-half share of the business. In September, 1924, they entered into an agreement to supply the X.L.O. Company with 15,000 pairs of headphones. Owing to delay on the part of the manufacturers of certain materials, the delivery of the first consignment was late, and in consequence the contract was cancelled. In February, 1925, they were sued for breach of contract, and judgment was given against them for £369, of which only £70 was paid at the date of the receiving order. They continued business until March, 1925, when their stock, machinery and effects were sold under an execution levied by another creditor. The discharge was suspended for three months.

H. N. SHORROCK, electrical engineer, Hollings Yard, Heysham Road, Morecambe.—Trustee, Mr. H. Parker, Official Receiver, 9, Cannon Street, Preston, released April 19th.

A. H. CRUMP (Selwyn Electrical Engineering Co.), electrical engineer, late of 184, 202 & 220, Walworth Road, S.E.—Last day for proofs for dividend, May 18th. Trustee, Mr. W. Boyle, Senior Official Receiver, Carey Street, W.C.

M. J. SCOTT (M. J. Scott & Co.), electrical engineer and contractor, 100, Jermyn Street, S.W.—Supplemental dividend of 2s. 1½d. in the £, payable at Carey Street, W.C.

H. B. POWELL, wireless dealer, 6, Chandos Street, and 10, Union Street, Hereford.—Second and final dividend of 1½d. in the £, payable May 10th at the Official Receiver's Office, 133, St. Owen Street, Hereford.

E. TEMPLE and J. E. BURKETT (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—First and final dividend of 2s. 8d. in the £, payable May 8th, at the Trustee's Office, 48, Pilgrim Street, Newcastle-on-Tyne.

E. R. MILLWARD (West of England Radio), wireless engineer, 67, High Street, Barnstaple.—Receiving order made April 29th on debtor's own petition.

A. B. GREGORY, wireless expert, 29, St. Albans Road, Seven Kings.—Bankrupt's discharge suspended for six months until September 18th, 1929.

K. P. J. JOLWARD.—CORRECTION.—In the list of creditors in this matter which appeared in our last issue p. 787, the name "P. W. Rawes" should have been P. W. Rands.

Company Liquidations.

KEYSTONE INVESTMENT TRUST, LTD., Bank Chambers, Kingston-on-Thames.—Under the compulsory liquidation of this company, the report of the Official Receiver and Liquidator shows that the trust was registered as a public company in April, 1923, with a nominal capital of £30,000, subsequently increased to £100,000, and was formed to undertake all kinds of financial and commercial business. It was promoted by W. H. Butler, whose real name was Brown, and who was found drowned in the Thames last October. According to the returns, 81,134 shares had been issued for cash, and practically the whole of the capital had been utilised in financing companies promoted and controlled by Butler. Among these were the Tidal Power Syndicate, Ltd. (£11,874); and Pinnacle Switchgear, Ltd. (£6,899). In July, 1924, Butler registered a company under the title of "Weaver Tidal Power Syndicate, Ltd.," with a nominal capital of £30,000. The name was altered to "Tidal Power Syndicate, Ltd.," in 1925. The object was to acquire certain land at West Mersea, Essex, in order to develop a project for utilising the rise and fall of the tides for the production of electric power. According to information furnished by Syminton, a director of the Syndicate, an option of the land had been acquired by a third party from one of the Loewenstein group of companies. Sums amounting to about £6,000 are said to have been paid in respect of the option. It appears, however, that the purchase was not completed. The Syndicate then purchased the land direct from the owners for £37,228, which was satisfied in part by a mortgage on the property for £16,000 and cash payments amounting to £17,758. Loans were made by the Trust from time to time, and at the end of 1924 there was a sum of £12,117 due to the Trust. This was satisfied to the extent of £12,065 by the issue to the Trust of debentures of the Syndicate of the nominal value of £12,700, which were subsequently disposed of to various persons stated to have been shareholders in the Trust. Further moneys were advanced by the Trust to the Syndicate and, according to the books of the Trust, there was at the end of 1926 a sum of £10,375 outstanding, which was wholly unsecured. To enable these advances to be made, the Trust appears to have borrowed sums amounting to £9,420 from shareholders during 1925, but no security was given. The Trust was also the registered holder of 15,000 of the Syndicate's shares, which were shown in the books at a cost price of £1,499. Syminton has informed the Official Receiver that it was intended that the Syndicate should promote a large public company in order to carry through the original scheme for the development of tidal power; that for this purpose it was essential that the assistance of the Trade Facilities Committee should be obtained, and that it was contemplated that a loan of at least £300,000 would be made, which, in view of the national importance of the project, it was understood would be forthcoming. Owing to lack of funds it was impossible to obtain the necessary reports from expert engineers, and the Trade Facilities Act

Committee thereupon refused the application for a loan. In August, 1927, the funds of the Syndicate were exhausted and, the interest on the mortgage being in arrear, the mortgagees commenced proceedings for payment of both principal and interest. The action came before the High Court early in 1928, but numerous adjournments were obtained by Butler on account of ill-health, and the case was in the list for hearing at or about the time of his death. According to Syminton, the Syndicate is without any funds or assets of any kind, and its operations have been suspended. Pinnacle Switchgear, Ltd., was promoted by Butler as a public company in April, 1925, with a nominal capital of £21,000; it was formed to carry on business as manufacturers of electric switches and fuses to be supplied principally to the Admiralty. According to information furnished by Easterfield (a former director), the company was a reconstruction of the Wholesale Electric Co., Ltd., which carried on business at Weybridge. The Trust acquired 250 shares of the Wholesale Electric Company in 1924, and subsequently took up debentures to the nominal value of £2,800. The company went into voluntary liquidation, and a reconstruction scheme was carried through under which the Trust, in exchange for its debentures and shares, was allotted 4,720 £1 preference shares and 19,993 1s. deferred shares in Pinnacle Switchgear, Ltd. Further shares were acquired by the Trust, some of which were subsequently sold. On December 31st, 1926, the Trust held 3,110 preference shares and 19,283 deferred shares, the cost of which was brought into the books at £3,839. Loans amounting to £3,060 were also made by the Trust which are still unsatisfied. It appears that the Switchgear Company created debentures for £3,000 in March, 1927, and that in the following August the debenture holder appointed a receiver, who carried on the business for a short time, and subsequently disposed of it for an amount which was insufficient to discharge the sum due under the debentures.

The Official Receiver further reports that, so far as can be ascertained, the assets of the Trust have no realisable value, and there is no probability of any assets becoming available in the liquidation for the benefit of the creditors or shareholders. The directors state that they are unable to express any opinion as to the cause of the failure. In the opinion of the Official Receiver the failure is directly attributable to reckless and extravagant mismanagement on the part of Butler. The conduct of the other directors calls for serious criticism, as they apparently allowed themselves to be entirely dominated by Butler.

Helikon Wireless Co., Ltd., 6, Park Royal, North Acton.—The winding up order herein was made recently. According to the statement of affairs there are liabilities amounting to £1,188 against net assets of £24, leaving a deficiency of £1,164. The issued capital of the company was £197, and as regards contributories there is a total deficiency of £1,361. The company was registered as a private company in November, 1925, for the purpose of carrying on business as merchants and dealers in wireless accessories with a nominal capital of £300. It commenced business with an office and warehouse in Camomile Street, E.C. In May, 1928, a factory was acquired, and the company began to manufacture electric lamps. Balance sheets and trading and profit and loss accounts for the year ended November 30th, 1926, showed a trading loss of £392, and for the year ended November 30th, 1928, there was a further loss of £393.

Super Electric Heaters, Ltd.—Winding up voluntarily. Liquidator, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Birmingham. A meeting of creditors is called for May 13th, at the liquidator's offices. Particulars of claims by May 27th.

Private Arrangements.

International Electric Co., Ltd., Ashley Road, Tottenham, N., telephone manufacturers.—A meeting of creditors, convened by Messrs. Stoneham & Sons, solicitors, 108a, Cannon Street, E.C., was held at the Midland Hotel, St. Pancras, on April 23rd. The chair was occupied by Col. Simpson (a director), who was stated to be the largest shareholder. Mr. Stoneham said that the company was registered in 1911, and at the outbreak of war the question arose whether the business could continue. It had been carried on with varying success until 1927, and in that year Col. Simpson, the chairman, took a hand in the management. He (Mr. Stoneham) was called in in the autumn of 1927, and he found that Col. Simpson had advanced without any security a sum of £10,000. He was called in to advise Col. Simpson as to what should be done, and he found that there was registered in 1923 an issue of debentures for £70,500. Even in 1927 the arrears of interest on these debentures were very considerable, and they now amounted to upwards of £20,000. Therefore there was a prior charge on the company's assets of not less than £90,000, and the amount might ultimately be found to be nearer £100,000. In 1927 it was considered that there was some prospect of success, and Col. Simpson thought that it would be worth his while to find further money for the company. Accordingly, an arrangement was made, the debenture holders were interviewed, and they expressed themselves as being willing to stand aside so far as their interests were concerned, and, moreover, that they would not take any immediate steps for the protection of their interests. An agreement was entered into under which Col. Simpson was given a certain amount of authority with regard to the affairs of the company, but he was given no security whatever. He was, in fact, to rank as an ordinary creditor. In addition to this, in the event of liquidation, he was to rank even behind the ordinary trade creditors. The object aimed at was to pull the company round and then make terms with the debenture holders. Col. Simpson would then have been satisfied to take his interest in shares. In the spring of 1928 it seemed as if the company were being pulled round. The business was becoming active and orders were being carried out, but great difficulty was experienced with orders which had been on the books for a considerable time and had to be cleared. Balance sheets were made up on November 30th in each year, and it appeared that at November 30th, 1927, the amount due to trade creditors was £8,746. A year later the balance due to creditors was £8,526, and during this period the purchases had amounted to between £30,000 and £40,000. The debenture holders could not be expected to let things remain as they were, and Col. Simpson felt that he could offer no more financial support; he had already provided £44,800. After many discussions they had come to the conclusion that the only alternative was a reorganisation scheme. Certain negotiations had taken place recently, and he thought there was a possibility of a reconstruction on sound lines, and that the company would then attain a new lease of life. It was quite evident that on the basis of the figures which he had submitted there was not the slightest chance of the trade creditors receiving a penny if a liquidation were to ensue. He appealed to the creditors to grant a moratorium, because under this scheme there was a prospect of some kind. If they would do this for six months the debenture holders would give their support, and creditors would, he hoped, support the company to the extent of supplying raw material and goods at competitive prices, against cash or guaranteed payment. It was also undertaken that if a receiver were appointed and this resulted in a realisation, then the creditors would be guaranteed to be paid 10 per cent. on the amount of their present debts. Mr. Stoneham said that three creditors had taken action, but it was hoped that these would fall in with the scheme. The total unsecured claims at the present time so far as trade creditors were concerned were £10,251. In reply to a question, Mr. Stoneham said that the holders of the debenture were William Deacon's Bank. Asked as to the value of the stock, it was stated that this amounted to about £23,000. Mr. Houston observed that the offer of the 10 per cent. to the creditors was really equivalent to a sum of about £1,000, which did not seem a very large amount. A long discussion ensued, in the course of which many creditors expressed their views, and the representative of Messrs. Mansell, Booth & Co., the second largest creditors, who had taken proceedings, stated that he could not at present undertake to fall in with the proposal made. He said that he had given the company four or five months' credit and felt rather perturbed about the present position. Other creditors said they thought it would be wise to accept the moratorium. Eventually a resolution was passed that the trade creditors should agree to grant a moratorium for six months from April 18th on such terms, being not less than 10 per cent., as the committee representing three of the principal creditors agreed to.

Receiver Appointed.

Hendon Electric Lamp Co., Ltd.—Mr. Harold Bell, 22, Bedford Row, W.C., informs us that he has been appointed receiver and manager for the debenture holder of this company.

Dissolution of Partnership.

Crofts & Smith, electrical, mechanical and radio engineers, Queen Street, Deal.—Mr. J. F. Crofts and Mr. E. W. Smith have dissolved partnership. Mr. Smith will continue the business.

An American "Trust" Inquiry.

The *Daily Mail* states that the Federal Trade Commission of the United States is inquiring into the propagandist activities of the American light and power industry. Mr. A. R. Graustein, president of the International Paper & Power Co., giving evidence, said that his company had acquired £2,000,000 of stock in 13 newspapers, but denied that his company had attempted to influence the editorial policies of those papers. Senator Norris, of Nebraska, described the light and power industry as "the greatest trust ever known," and accused it of seeking with money subscribed by the public to gain control of schools, churches, civic organisations, legislative bodies, the Press, and broadcasting systems.

Lamp Standardisation in Holland.

The Dutch main committee on standardisation has appointed a sub-committee for studying the standardisation of electric glow lamps, under the chairmanship of Prof. H. S. Hallo, of the Technical High School, Delft, and a meeting was recently held to consider the working programme. It is proposed to deal with both gasfilled and vacuum lamps; and the questions of voltage, energy consumption, the form of the lamp, shape of the wire, &c., are to be considered for ordinary and special types.

The National Radio Exhibition.

We have received from the Radio Manufacturers' Association some particulars of this year's National Radio Exhibition which is to be held in the New Hall, Olympia, from September 23rd to October 3rd. These include plans of the "lay-out" of the ground floor and the gallery, together with a schedule of charges for space; the Board of Trade requirements with regard to the provisional protection of inventions; and a formal contract for space. Space is to be allotted by ballot to firms whose applications are received by May 31st.

New Catalogues and Lists.

THE LANCASHIRE DYNAMO & MOTOR CO., LTD., AND THE CRYPTO ELECTRICAL CO., LTD.—A folder outlining the history of the companies, with illustrations showing the "Lancashire" and "Crypto" works.

THE WHOLESALE FITTINGS CO., LTD.—List No. W.233, dealing with radio receiving sets, including portable outfits and radio components.

PHILIPS LAMPS, LTD.—Publication No. 404, a priced and illustrated folder showing industrial lighting fittings, outdoor lanterns, and a foot-candle meter.

THE ZENITH ELECTRIC CO., LTD., Villiers Road, Willesden Green, N.W.2.—A priced and illustrated catalogue of various types of regulating resistances, and a pamphlet describing the company's choke coils with adjustable air gaps, &c.

THE MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Denmark Street, W.C.2.—"Radio for the Million," Vol. 3, No. 1, describing the "S.G.P. Master Three" set incorporating screened grid and "Pentone" valves.

"Z" ELECTRIC LAMPS & SUPPLIES, LTD., 73, Newman Street, Oxford Street, W.1.—A well-illustrated price list of electrical accessories—switches, adapters, plugs and sockets, brackets, &c. Also a comprehensive catalogue of "Association" lamps, including a discount chart.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—An illustrated price list of "Ediswan" dry-charged automobile lighting and starting batteries and accessories.

ELECTRIC NEWS PANELS, LTD., 14-17, Wells Street, W.1.—A well-produced brochure, illustrated in colour, advertising the company's animated electric letter signs.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The May "Osram-G.E.C. Bulletin," containing illustrated articles on the lighting of roads and buildings with the company's fittings and lamps; radio valves and sets; "Magnet" domestic appliances, &c. Also a series of revision sheets for the company's large blue catalogue of "Everything Electrical."

Calendar-blotters for May have been received from POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.C.2; MAVOR and COULSON, LTD., 47, Broad Street, Mile End, Glasgow; S. ROGERS & CO., LTD., 15, Fitzroy Street, W.1; the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; and WARREN BROS. (MIDDLESBROUGH), LTD.

MESSRS. HENRY WALLWORK & CO. (1920), LTD., Roger Street, Manchester.—A series of illustrated pamphlets containing particulars of the company's worm and spur gears.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—An illustrated leaflet (E.1538) describing the "A.E.G." phantom load for calibrating a.c. watthour meters. Also a leaflet describing a two-part tariff prepayment meter. Illustrated and priced.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—A 40-page booklet containing illustrated details and prices of the company's receiving sets, battery eliminators, chokes, transformers and other radio apparatus; and a folder giving particulars and performance curves of the "Hypermu" transformer.

Fire.

The *Liverpool Post* reports that damage estimated at £25,000 was caused by a fire which occurred on May 1st at the premises of Messrs. H. T. Boothroyd, Ltd., Akenside Street, Bootle, electrical and mechanical engineers.

Prices of Raw Materials.

Messrs. F. SMITH & Co. and Messrs. JAMES & SHAKESPEARE, report, May 7th.: No change in copper and lead prices.

Messrs. EDWARD TILL & Co., report, May 7th: India rubber, para fine 11½d., 1½d. inc.

Reporting on May 4th, Messrs. James Forster & Co. stated that a firmer tone was apparent in the lead market last week. Prices opened steady on Monday, and slightly advanced until Friday, when there was a small setback. Conditions in the market are very quiet. A little more business has been passing this week with consumers, chiefly for prompt lead, although the aggregate does not amount to much. However, with arrivals scarce, and consequently no selling pressure, it is not surprising that prices have kept up in the face of the small demand. If consumers can hold off buying until further supplies from Mexico arrive, lower prices seem to be indicated. On the other hand, if they are forced to enter the market under the present conditions of short supplies, higher prices will result.

Lighting and Power Notes.

Australia.—PERTH (W.A.).—According to the *Electrical Engineer of Australia and New Zealand*, tenders are to be called shortly for plant for extending the West Australian Government power station at East Perth. The station provides bulk supplies to the Perth and Fremantle Municipal Councils, the Perth tramways and other authorities, and retail supplies in the area around Perth. An extension of plant bringing the total capacity up to 32,000 kW was completed last year, but owing to the increasing demand, further plant will be required by 1932. The Government, therefore, is preparing to call for tenders for an additional 12,500-kW turbo-alternator and two 65,000-lb. boilers, with all necessary auxiliary plant. The estimated cost of the extensions is £216,845.

VICTORIA.—The Sugarloaf hydro-electric power station was formally inaugurated by the Premier (Sir William McPherson) on March 20th. The plant consists of two 9,000-h.p. turbines direct-coupled to 7,200-kVA alternators. During the winter months when the reservoir is being filled there will not be sufficient outflow to operate the turbines, and the load will be taken up by the stations on the Rubicon river, which have been in operation for some time. In the summer there is not sufficient water to fully operate the Rubicon stations, and the main load will be carried by the Sugarloaf plant.

Bicester.—ELECTRICITY SCHEME.—At a recent public meeting, Mr. A. J. Bridge, of the Western Electricity Supply Co., Ltd., which is carrying out the electricity scheme for the district, explained the system of charges for electricity supply in the town, and other details of the scheme.

Birkenhead.—LOANS.—The Corporation Electricity Committee has received sanction to a loan of £2,200 for laying an e.h.p. main from Upton to Greasby and £1,360 in connection with the extension of h.p. mains and additional switchgear at the Singleton Avenue sub-station.

The Committee is applying for sanction to a further loan of £1,754 for h.p. mains.

Burnley.—LOANS SANCTIONED.—The Corporation has received sanction to loans of £6,260 for the construction of stores for the Electricity Department, and £35,000 to meet anticipated expenditure on mains during the next three years.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Resumption of work on the Ontario Hydro-Electric Power Commission's 54,000-h.p. development at Alexander Landing, on the Nipigon river, is to take place immediately. This undertaking, which is scheduled for completion in 1931, is stated to involve an expenditure of approximately $6,000,000, and is required to meet the growing demand for power on the Thunder Bay system.

The Provincial Water Board of British Columbia is shortly to take evidence in support of three competing applications for water power licences in connection with the Campbell River Falls, at which it is believed that 40,000 h.p. could be developed. This figure could be increased to 75,000 h.p. by the use of Buttles Lake as a reservoir. The three companies which have applied for the licences are the British Columbia Power Corporation, the Campbell River Power Company, and the Crown Willamette Company.

Cardiff.—YEAR'S WORKING.—Mr. E. Morley New, borough electrical engineer, reported to a recent meeting of the Electricity Committee that in the past year 5,527 consumers were added, an increase greater than the total number of consumers connected during the first 25 years of the undertaking. The electrical energy sold was estimated at 40,250,000 kWh, an increase over the previous year of nearly 2,000,000 kWh.

Chester.—LOAN.—The City Council has received sanction to a loan of £18,000 for overhead mains and £2,000 for outdoor sub-stations and equipment in connection with a supply of electricity to Kelsall in the area of the Northwich Rural District Council.

Chesterfield.—ELECTRICITY SUPPLY PROGRESS.—We are informed by Mr. D. H. Davies, borough electrical engineer, that during the past two years the Electricity Department has spent £55,311 on 62 miles of new mains, and has connected 4,100 new consumers. So great is the demand on the department that an application for a loan of £43,355 is to be made for further extensions of e.h.p. and l.p. feeders, l.p. distributors, &c. There are now 14,000 houses in the borough, over 8,500 of which are supplied with electricity, and it is anticipated that during the next three years practically the whole of the houses in the borough will be using electricity at least for lighting purposes.

China.—SHANGHAI.—*Year's Working.*—We have received from Mr. T. H. U. Aldridge, engineer-in-chief and manager of the Municipal Electricity Department, a copy of his report for the year ended December 31st, 1928. The electrical energy generated totalled 527,779,842 kWh, as compared with 470,195,088 kWh in 1927, and the total sales were 458,360,215 kWh, as against 400,343,385 kWh. The year's trading resulted

in a net surplus of Tls. 3,165,300 (£395,662), and the estimated net profit for 1929 is Tls. 3,517,550 (£414,694). The total revenue amounted to Tls. 12,846,604, as compared with Tls. 11,431,130 in the preceding year. The capacity of the plant installed and in actual service remained at 121,000 kW. The section of the power station in which this plant is installed will in future be known as Riverside "A," and the section in which the two new 20,000 kW turbo-alternators and four boilers equipped for pulverised coal firing are now being completed will be known as Riverside "B." Importance is attached to the future performance of Riverside "B" in comparison with "A" so that the net decrease in cost of production under the new conditions may be carefully ascertained. The highest maximum peak load recorded was 99,000 kW, the maximum sustained load for 30 min. was 98,500 kW, and the maximum load delivered to the feeders was 95,250 kW. The maximum load for 1928 was exceeded in January this year, when it rose to 104,500 kW. The load factor was 61 per cent. as compared with 59.91 per cent. in the previous year, and the overall efficiency was 17.6 per cent. as against 17.41 per cent. There was an increase in the number of premises connected of 4,564, bringing the total to 63,927, and the consumers supplied totalled 50,532, an increase of 3,514. The connected load was 193,895 kW, additional connections during the year amounting to 18,976 kW. The record of work carried out by the distribution section indicates development over the whole system. The capacity of transformers installed increased by 25,400 kVA, bringing the total capacity to 394,291 kVA, and additional cables laid totalled 45 miles, making 488 miles in addition to overhead lines. At December 31st there were 8,494 motors, aggregating 147,074 h.p. connected to the mains, showing a net increase of 1,154 (11,461 h.p.) during the year. The heating and cooking load connected represented 34,141 kW, an increase of 7,352 kW on the figure for the previous year. The *personnel* of the undertaking at the end of the period under review consisted of 305 "foreigners" and 3,140 Chinese.

Colchester.—LOAN.—The Corporation Electricity Committee has obtained sanction to a loan of £4,776 for a main transmission line to Wivenhoe, and switchgear, &c., and £28,670 for the provision of further generating plant at Hythe generating station.

Continental.—BULGARIA.—The new steam-operated power station at Kourilo, near Sofia, was recently inaugurated in the presence of the King of Bulgaria. So far two turbo-generator sets, each of 6,400 kW capacity, have been installed, but a third set of similar capacity is on order, and is expected to be ready by October next. A second 35,000 V double-transmission line is to be erected between Kourilo and Sofia.

ITALY.—A new hydro-electric power station has recently been completed and put in operation at Isollaz by the Società Idro-elettrica dell' Evancon. The plant, which utilises the power of the River Evancon in the Austa Valley, comprises two 24,000-h.p. turbines and generators. Electricity is generated at 6,000 V and stepped up to 135,000 V for transmission to the province of Piedmont and the city of Turin.

GERMANY.—A return recently issued by the German Government Statistical Department shows that the output during last year of 122 leading electricity supply undertakings in the country amounted to approximately 14,400,000,000 kWh, as against 12,410,000,000 kWh in 1927. The department estimates that the returns cover only half the total output in Germany, which for 1928 it estimates at 29,000 million kWh, an increase of 4,000 million kWh, or 16 per cent. over 1927.

BELGIUM.—On the occasion of submitting his annual budget to Parliament, the Belgian Minister of Agriculture referred to the rapid progress which was being made in providing electricity supplies in the agricultural districts and villages of Belgium. He stated that whereas in 1914 there were only 500 villages so supplied, the number is now 1,998, or approximately 71 per cent. of the total.

Coventry.—LOAN.—The City Council is applying for sanction to a loan of £7,621 for extensions to mains and sub-stations.

Halifax.—LOAN.—The Town Council has applied for sanction to a loan of £30,000 for mains.

Holbeach.—STREET LIGHTING.—The Urban District Council has accepted the tender of the Boston and District Electric Supply Co. for public lighting with 76 standards at £263 per annum.

Hull.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of a further sum of £73,618, made up as follows:—£49,339 for the conversion of boilers and boiler house building, and £24,279 for buildings, &c., and cooling tower super-structures. Approval has also been received to a balance in hand of £90,973 in respect of the £200,000 for plant sanctioned in 1925 being applied towards expenditure incurred or to be incurred on plant provided for under the £481,500 scheme, making a total (including the £250,000 previously sanctioned) of £340,973 available for plant. The Electricity Commissioners state that they will be prepared to consider sanctioning the borrowing of further amounts in respect of the application for £481,500 upon receipt of a revised detailed estimate of the final cost of the works.

Irish Free State.—LIMERICK.—The Mayor, the city surveyor, and the law adviser to the Corporation recently interviewed Dr. T. McLoughlin, managing director of the Electricity Supply Board, and Mr. P. J. Tierney relative to the proposed distribution system for the city and district, when it was explained that the h.p. cables would be underground. A commencement with the work, which will cost £32,000, will be made during the present month, and a supply of electricity will be available from the temporary power station at Ardnacrusha by September next, and from the hydro-electric station in March.

Ilford.—LOANS.—The Corporation Electricity Committee has obtained sanction to a loan of £50,000 for mains and services and £5,000 for house wiring installations.

The Committee is applying for sanction to a further loan of £5,000 for domestic apparatus to be let out on hire.

London.—TWO-PART TARIFFS.—The South Metropolitan Electric Light & Power Co. announces the introduction of the following two-part tariffs for both domestic and business purposes. Domestic "All-in" rate: Standing charge based on dimensions of premises plus 1d. per kWh. Business "All-in" rate: Standing charge of 6s. 3d. per quarter per 100 watts of installed lighting capacity plus 1d. per kWh consumed.

A similar tariff has been introduced by the South London Electric Supply Corporation, Ltd.

Maidstone.—INQUIRY.—Mr. F. Gordon Tucker, for the Ministry of Transport, held an inquiry on May 1st into the application of the Town Council to erect an overhead 6,000-V cable to Aylesford, Ditton, and East Malling. There were objections by four landowners and one occupier. The borough electrical engineer (Mr. E. E. Hoadley) said that the Corporation wanted to supply the Empire Marketing Board fruit preservation station, and the East Malling Research Station, and continue to West Malling, where it had already contracted for street lighting. One objector asserted that land would be wasted round each pole, and he also protested against the disfigurement of the countryside by the poles. The inspector said that if electricity was to be supplied in the rural districts, overhead lines would have to be used.

New Zealand.—DUNEDIN.—Negotiations are in progress between the Government and the Dunedin City Council for the purchase by the Government of the Council's hydro-electric plant at Waipori Falls. The Government has offered to buy the works for the sum spent on construction by the Council (about £500,000), and to sell energy in bulk to the Council for the price at which it now generates. Extensions to the Waipori undertaking have been authorised by the Council, but it is considered that the Government, if it took over, would not proceed with the full programme of works, as the Waitaki development will be in operation in a few years.

Price Reductions.—Reductions in the charges for electricity have been made or are recommended in the following districts:—

LLANFAIRFECHAN.—Heating and cooking: 2d. per kWh for the first 200 kWh, and 1½d. per kWh in excess of this amount.

RUTHIN.—*Electric Supply Company.*—Lighting: from 10d. to 9d. per kWh.

LIVERPOOL.—For Liverpool, Bootle and Litherland: Flat rate varying from 3¾d. to 2¾d. per kWh, according to the quantity consumed. For Little Crosby: flat rate for lighting 6d. per kWh, power 2d. per kWh. The city electrical engineer, Mr. P. J. Robinson, has recommended that the ratable charges applicable in the city should be extended to various areas outside the city.

Ripon.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £530 for a sub-station building, £14,715 for mains and services, £2,468 for plant (switchgear and transformers), and £600 for meters.

ELECTRICITY IN BULK.—The Electricity Commissioners have approved the agreement between the Corporations of Harrogate and Ripon for a bulk supply of electricity.

Shipley.—LOAN SANCTIONED.—The Urban District Council Electricity Committee has obtained sanction to a loan of £9,861 for mains.

South-East Lancs. Electricity Advisory Board.—GENERATING STATISTICS.—The electrical energy generated by authorities in the area covered by the Board for the year ended December 31st last totalled 1,047,372,951 kWh, of which 465,951,930 kWh was generated at the Manchester Corporation power station, and 119,190,721 kWh by the Lancashire Electric Power Co.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Lancaster Corporation authorising it to supply electricity in the rural district of Lunesdale and parts of the rural district of Lancaster.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Bournemouth and Poole Electricity Supply Co., Ltd., to supply electricity in the urban district of Wimborne Minster and parts of the rural districts of Poole and Wimborne and Cranborne.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport.—Dulverton Rural District; Exe Valley; Macclesfield Electricity (Extension); Withernsea and Patrington; and Wiveliscombe and Wellington Rural.

Uttoxeter.—ELECTRICITY SCHEME.—In connection with the electricity scheme, the Urban District Council has decided to carry out the compulsory work, and to prepare a scheme for the wiring of houses.

Tramway and Railway Notes.

Blackpool.—YEAR'S WORKING.—Over 52¼ million passengers were carried on the Corporation tramcars and 'buses during last year. Tramway passengers numbered 42,456,648 (a reduction of 68,208). The receipts were £309,855 (a reduction of £3,403). The number of car-miles run totalled 3,476,753.

Halifax. — LOAN SANCTIONED. — The Town Council has received from the Ministry of Transport sanction to a loan of £8,576 for the reconstruction of portions of the tramway.

Lanarkshire.—TRAMWAY ABANDONMENT.—The Lanarkshire Tramways Company has been granted permission to run 'buses over the route at present served by its tramway. This is the result of a recent inquiry into a Provisional Order sought by the company.

Liverpool.—NEW TRAMCARS.—The Corporation will shortly put into service a fleet of 14 new tramcars which will embody many new features. In addition to mechanical improvements, the cars will be entirely enclosed, the conductor and driver being protected from the weather. On the top decks upholstered seats will be introduced in place of the wooden seats in use on the existing cars.

London.—L.C.C. TRAMWAY ESTIMATES.—The Highways Committee of the L.C.C. has submitted a report on the annual estimates in respect of the tramway undertaking for the year 1929-30. The estimated total revenue is £4,387,900, and working expenditure £3,616,335, leaving a gross surplus of £771,565. After payment of debt charges, the estimated net surplus is £40,899. The amount to be voted on capital account is £415,920, the principal items being the deepening of the tramway subway from the Victoria Embankment to Southampton Row, and the consequent reconstruction of single-deck cars, new plant at the Greenwich power station, and the improvement of cars. In addition, a provisional sum of £269,200 has been included to cover expenditure which may be incurred on the construction of new tramways from a point near Grove Park Station to Well Hall Road, Eltham, the provision of new cars, improvement of cars, and sundry works, making a total estimate of £685,120.

ALL-NIGHT TRAMWAY SERVICES.—It has been recommended to the L.C.C. that it be referred to the Finance and Highways Committees to consider and report as to the submission of a supplemental maintenance estimate of £1,000 for the development and improvement of all-night services, especially in the east and north-east districts of London.

Manchester.—TRAMWAY ABANDONMENT.—The Tramways Committee has decided to discontinue the tramway service from Stretford Road to Cheetham Hill Road and to substitute 'buses.

Oldham.—TRACK RENEWAL.—The Corporation Tramways Committee is to relay the tramway track in Copster Hill Road at an estimated cost of £4,000.

South Africa.—ELECTRICITY CHARGES FOR RAILWAYS.—The Durban correspondent of *The Times Trade and Engineering Supplement* reports that the Railway Administration is so dissatisfied with the charges for electricity for the railways made by the Electricity Supply Commission that it has declined to consider the electrification of the Durban-Maritzburg line, with the result that the Durban Municipality will be the only big purchaser of electricity from the Commission's new power station, and will have to bear the whole cost of this undertaking alone. In giving evidence before the Select Committee on Railways and Harbours, Mr. J. R. More, the general manager of railways, stated that they were losing £300,000 on the Capetown-Simonstown line compared with £100,000 under steam. He stated that the price of electricity (1.3d. per kWh) was far too high. They were paying the Commission more for their power to-day than they paid the Cape Municipality before the Commission erected the station. The charge for power supplied from the Colenso station was 0.8d. per kWh, and it was contended that electricity was being produced at a cheaper rate on the Rand. The consulting engineers had estimated that the annual working expenses on the Simonstown line would be £169,000 per annum; actually to-day they were £488,000. The Select Committee reported that the reasonableness of the Commission's charges under the heading of administration and general charges would appear to be in question, and recommended that the whole matter should be referred to the Electricity Control Board, which is under the Minister of Mines.

United States.—NEW YORK.—A collision which occurred between a Lexington Avenue subway train and a Ninth Avenue "elevated" train near 167th street station on April 29th, resulted in the death of four passengers and serious injuries to 25 more. The accident took place during the morning "rush" hours, and the two trains were carrying over 3,000 passengers. Several coaches of each train were badly smashed.

York.—TRAFFIC RECEIPTS.—Since the introduction this year of a 1d. service on the Corporation tramways and 'buses instead of the universal 2d. fare, the receipts have been considerably below expectations. It will be proposed at the next meeting of the Tramways Committee that the Committee revert to the old fares with the provision of 1d. on all routes from the centre of the city.

Telegraph and Telephone Notes.

International Telephony.—FRANCE—FINLAND.—A telephone service between France and Finland was to be inaugurated on May 1st.—*Reuter* (Paris).

SWEDEN-SPAIN.—Telephone communication between Sweden and Spain was inaugurated on April 15th.

Irish Free State.—SHANNON TELEPHONE SYSTEM.—At a meeting of the Wireless Society of Ireland in Dublin last week, Mr. J. Mendelson, on behalf of Messrs. Siemens Schuckert (Ireland), read a paper on telephone communication for electric power systems as applied to the Shannon scheme, explaining the working of the system. The system will be independent of the public system and the high-voltage power lines will be used, thus saving the cost of paying for a public system. So strong will these lines be that they will be able to resist the heaviest storms and snowfalls. The lines will run only between the transforming stations and power station.

The Telephone Service.—NEW INSTRUMENTS.—The Postmaster-General announces that 60,000 new telephone transmitters and receivers, all of British make, have been ordered. In contrast to the candlestick pattern, the new instruments are of the cradle pattern, combining mouthpiece and earpiece in one unit for greater convenience in handling.

Transatlantic Telephony.—PROPOSED CABLE.—The London *Evening News* learns that the American Telephone and Telegraph Co. is to make an immediate request for a licence to land a telephone-telegraph cable in England, or in Ireland, within the next few months. It is understood that only a few more trial tests need be undertaken. The cable will carry one telephone message each way simultaneously with eight or ten telegraph channels worked on the same principle as that of existing loaded cables across the Atlantic. The new cable will take about three months to make and about two months to lay. The A.T.T. is now only waiting to place the order. Three American engineers have just returned to New York after looking for the most suitable landing place in this country. They also had interviews with the Irish Free State Government on the subject, but, under the Irish settlement, no agreement can be reached without the sanction of the British Government.

Radio Notes.

Common Wavelength.—SWANSEA.—The B.B.C. announces that the Swansea station has been included among those stations transmitting on the national common wavelength of 288.5 metres (1,040 kilohertz); the change took place on May 7th. The Swansea station formerly transmitted on a frequency of 1,020 kilohertz (294.1 metres).

Manchuria.—NEW STATION.—A wireless station was opened on May 1st at Khabarovsk, on the Manchurian frontier, by the Soviet authorities, to cater for the "cultural needs of the Chinese peoples." The programme was in the Chinese, English, and Korean languages, but the regular daily programme will be chiefly in Chinese.—*Reuter's* (Riga).

New Zealand.—LICENCES.—At the middle of March, 1929, some 44,084 listeners', 1,490 dealers', and 184 transmitting licences were in force in the Dominion. The Postmaster-General decided not to accede to the request made recently by radio dealers to allow the establishment of four "B Grade" stations. The proposal was to form a company to run the stations and to provide continuous programmes from early morning till midnight. No subsidy from the Government or any share of the licence fees was asked for, it being proposed to obtain the necessary revenue by using 10 per cent. of the total broadcasting hours for publicity purposes. The stations would not interfere with the Radio Broadcasting Company, as the new company would be prepared to use the present silent hours and to keep "off the air" when the YA stations were broadcasting. There will, however, be one "B" station, says *World-Radio*, namely, 2YB, New Plymouth, which is shortly to begin broadcasting under the combined control of the R.B. Company and the North Taranaki Radio Society, on a wavelength of 244 metres.

South Africa.—LICENCES.—Broadcasting has not attained the success which was anticipated when the African Broadcasting Co. was formed. About two years ago there were 12,872 listening licences in the Union; to-day the number is 16,764, so there has thus been an increase of 3,892, but it is not considered sufficient. The Johannesburg area leads with 7,120 licences, compared to 5,638 two years ago. Next comes the Cape area with 5,335, as against 3,894, an advance of 1,441. Durban can only show an increase of 969. "Pirates," says *World-Radio*, still flourish, notwithstanding prosecutions. Johannesburg again leads with 204 convictions, as against 61 in Cape Town and 19 in Durban. Therefore the practice, which has always had a serious retarding effect upon broadcasting in South Africa, has by no means ceased.

United States.—Valve Licences.—A change in the thermionic valve-licensing policy of the Radio Corporation of America, which is interpreted by radio engineers as the first step toward making R.C.A. valve licences available to a number of independent radio manufacturers of the country, is announced by General James G. Harbord, president of the Corporation. Thirty radio concerns are now licensed under the radio set, power amplifier, and speaker patents of the R.C.A. and its associates, but none has been authorised until now to manufacture under its valve patents.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Aughton.—May 23rd. West Lancashire R.D.C. Electric lighting scheme for the parish. Specifications (£2 2s.) and form of tender from Mr. James Scott, 358, Royal Liver Building, Liverpool.

Australia.—Melbourne.—June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 26th (extended from May 15th). Victorian Railways. One geared three-phase electric winding engine. (A.7650 and A.7853.)*

June 18th. Posts and Telegraphs Department. Switchboard cable. (B.X. 5228.)*

June 25th. Telephone cable terminal boxes of the protected type. (B.X. 5231.)*

Sydney.—June 22nd. Public Works Department. Transformers and spares for Burrinjuck hydro-electric development sub-stations. (B.X. 5230.)*

June 4th. 18 electrically-operated water level indicators. (B.X. 5233.)*

July 10th. New South Wales Government Railways. One 750-kW turbo-alternator for Ultimo Power Station. (Specification No. 847, 5s.) 2,200-V ironclad switchgear for Argyle sub-station. (Specification No. 852, 2s. 6d.) Two switch operating batteries. (Specification No. 850, 2s. 6d.) Two motor-generator sets. (Specification No. 851, 2s. 6d.) Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

Belfast.—May 21st. Electricity Department. Supply, delivery and erection of h.p. armour-clad switchgear, air pre-heaters, 22,000-V 3-phase transformers, and cable drum trailer and tractor. (May 3rd.)

May 21st. Supply, delivery and erection of a 22,000-V 3-phase overhead transmission line. (See this issue.)

Chile.—Valparaiso.—June 1st. Port Administration. Four three-metric-ton electric travelling cranes.

Colchester.—May 18th. Electricity Department. Supply and delivery of four miles of e.h.p. and seven miles of l.p. underground cable. (See this issue.)

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal handling plant, &c., engine room extension, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (See this issue.)

Cullingworth.—Installation of electric lighting at Conservative Club. Secretary, Conservative Club, Cullingworth, near Keighley.

Edinburgh.—May 21st. District Board of Control. Electrical work for the two higher grade blocks and mortuary at Gogarburn. Schedules from S. Kaye, architect, 14, Hill Street, Edinburgh.

May 30th. Electrical installation at George Heriot's School, Edinburgh. Specifications from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

Epsom.—May 25th. Electricity Department. Supply, delivery and erection of a l.p. d.c. switchboard. (See this issue.)

Glasgow.—May 16th. Electricity Department. Supply of cables, cookers, meters, arc lamp carbons, and kettles for 12 months. (May 3rd.)

Hastings.—June 3rd. Boiler fuel for period commencing July 1st, 1929. (See this issue.)

India.—May 21st. India Stores Department. One 400-kW, 6-phase rotary convertor set and accessories for H.M. Mint, Calcutta. (B.X. 5255.)*

May 27th. 500-kW, 6-phase rotary convertor, starting panel, &c. (B.X. 5279.)*

Kearsley.—May 20th. U.D.C. Electric wiring of 80 houses, Tasker's Lane Estate. Specifications from Mr. E. Shaw, surveyor.

Larne.—May 22nd. Board of Guardians. Installation of electric light at the District Hospital. Forms of tender from Mr. W. Pleasance, 44, Wellington Place, Belfast.

London.—Bethnal Green.—May 22nd. Borough Council. Electric lighting installation at two blocks of tenement dwellings. (May 3rd.)

Central Electricity Board. May 25th. Supply, delivery and erection of 33,000-V metal-clad switchgear for South-East England Electricity Scheme, 1927. (May 3rd.)

Woolwich.—May 15th. Union Guardians. Supply of electrical refrigerator. (May 3rd.)

St. Pancras.—Supply and fixing of an electric motor-driven centrifugal pump. (See this issue.)

Manchester.—May 14th. Tramways Committee. Trolley wire (cadmium copper), and copper bonds for tramway rails. Specification from General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Melton Mowbray.—Urban District Council. Wiring Egerton Lodge, Melton Mowbray. Forms of tender from Mr. W. H. Jarvis, surveyor, Corn Exchange, Melton Mowbray.

New Zealand.—Auckland.—June 3rd. Auckland Electric Power Board. Pilot cable and accessories. (B.X. 5244.)*

Wellington.—June 18th. Posts and Telegraph Department. Telephone cords. (B.X. 5251.)*

July 16th. Telephone bells. (B.X. 5272.)*

August 6th. Public Works Department. One 120-ton four-motor overhead travelling crane and runway. (A.X. 7810.)*

August 13th. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

Ogmore and Garw.—May 31st. Electricity Department. A short length of 11-kV transmission line, and l.p. overhead and underground mains. (See this issue.)

Richmond.—May 22nd. Board of Guardians. Re-wiring, &c., for electric light buildings at the Grove Road Institution, Richmond. (Deposit £1). Particulars from Mr. C. L. Fenn, clerk, Guardians' Offices, Parkshot, Richmond, Surrey.

Rothwell.—May 14th. West Riding Education Committee. Installation of electric light at Robin Hood Council School. Mr. Beaumont, West Riding Education Offices, 8, St. John's North, Wakefield.

South Africa.—Johannesburg.—June 20th. South African Railways and Harbours. One 10-ton and three 4-ton electric level luffing cranes. (A.X. 7828.)*

Pretoria.—May 23rd. Posts and Telegraphs Department. Rubber-covered wire and telephone cables. (B.X. 5229.)*

June 27th. Automatic wall and table-pattern telephones. (B.X. 5273.)*

May 30th. Telegraph materials, &c. (A.X. 7767.)

May 20th. Town Council. Cables, switchgear, and transformers. (B.X. 5245.)*

May 27th. Transformers. (B.X. 5258.)*

Uruguay.—Montevideo.—May 22nd. National Administration of the Ports. Four electric cranes (to lift 3 metric tons) mounted on trucks. (A.X. 7814.)*

Wrexham.—Borough Council. Wiring of 36 houses on Huntroyd estate. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Billingham.—Durham County Education Committee. Recommended:—

Electric lighting at new Council School (£404).—F. Reid Ferens & Co.

Bournemouth.—Pavilion Committee. Accepted:—

Electric wiring and lamps for canopy lighting at Pavilion.—Aish & Co.

Dartford.—Electricity Committee. Recommended:—

L.p. switchgear for Lowfield Street sub-station (£108), and feeder pillar in Miskin Road (£71).—Johnson and Phillips, Ltd.

Eastbourne.—Electricity Committee. Accepted :—
Transformers (£2,307).—British Electric Transformer Co., Ltd.

Glasgow.—Tramways Committee. Accepted :—
Insulated bolts.—British Insulated Cables, Ltd.
Lighting Committee. Recommended :—
Cables.—Greenwich Cable Works, Ltd.; Metropolitan Electrical Cable & Construction Co., Ltd.
350 steel poles.—Bromford Tube Co., Ltd.
Watch Committee. Recommended :—
Electrical work at new police station at Millerston (£275).—A. A. M. Turnbull & Co.

Halifax.—Corporation Electricity Committee.
Two steel boilers, buildings, and auxiliaries, at the power station (£83,411).—Babcock & Wilcox, Ltd.
Switchgear for new turbo-alternator (£720).—British Thomson-Houston Co., Ltd.

Hull.—Health Committee. Accepted :—
Electric light and bell installation at Maternity Home, Hedon Road (£2,080).—A. Shaw & Sons.

Irish Free State.—Electricity Supply Board. Distribution system for the city of Limerick :—
H.p. cables.—Siemens-Schuckert.
Transformer kiosks.—Metropolitan-Vickers Electrical Co., Ltd.
L.p. distribution network.—Callender's Cable & Construction Co., Ltd.
The total value of the contract is approximately £32,000.

Leeds.—Electricity Committee. Accepted :—
Cables.—(£867), W. T. Henley's Telegraph Works Co., Ltd.; (£1,146), Enfield Cable Works, Ltd.; (£215), Macintosh Cable Co., Ltd.; and (£1,171), Hackbridge Cable Co., Ltd.
24 circuit breakers.—(£396), Park Royal Engineering Co., Ltd.
30 fuse panels.—(£350), Parmiter, Hope and Sugden.
Transformers.—Ten 100 kVA, 2,000 V, single-phase and 10 200 kVA (£2,760), British Electric Transformer Co., Ltd.; 6 100 kVA, 6,600 V (£498), English Electric Co., Ltd.; 10 100 kVA, 6,600 V, and 20 200 kVA (£3,010).—Hackbridge Electric Construction Co., Ltd.
Switch house crane (£698).—Isles, Ltd.
Sub-station switchgear (£7,235).—General Electric Co., Ltd.
Four circulating water screens (£2,703).—F. W. Brackett and Co., Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee.
Electric goods lift at Trade School, Hammersmith :—

PICKERINGS, LTD. (Accepted.)	£523
E. A. Foulds	550
R. A. Evans	599
John Bennie, Ltd.	695
Smith, Major & Stevens, Ltd.	698
Marryat & Scott, Ltd.	700
Rawlinsons, Ltd.	702
Herbert Morris, Ltd.	734
Medway's Safety Lift Co., Ltd.	791

SOUTHWARK.—Electricity Committee Accepted :—
Boiler alterations (£355).—Vickers Boiler Co., Ltd.
ADMIRALTY.
W./t. combined switch and plug, switches, non w./t., steel springs, and gangway reflectors.—Edison Swan Electric Co., Ltd.
GENERAL POST OFFICE.
Charging tablets.—Edison Swan Electric Co., Ltd.

Manchester.—Tramways Committee. Accepted :—
Automatic point controllers.—Forest City Electric Co., Ltd.
Sub-contractors for electrical switchgear, cables and lighting in connection with extension of Hyde Road car works.—A. E. Sudlow & Co.
Tramcar trucks.—Brush Electrical Engineering Co., Ltd.
Electric rail-welding equipment.—Equipment & Engineering Co., Ltd.
Electricity Committee. Accepted :—
One 10,000-kVA air-cooled static transformer for Oldham Road sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
33,000-V switchgear for sub-stations and Barton power station.—Ferguson, Pailin, Ltd.; British Thomson-Houston Co., Ltd.
Education Committee. Accepted :—
School electrical installations : at Hough Road school.—Sudlow & Co. At Kingsway school and School Lane school.—John Adams, Ltd.

Oldham.—Buildings Committee. Accepted :—
Electric light installation at 200 houses on the Limeside Estate.—Hall & Stinson.

York.—Education Committee. Recommended :—
Electric lighting installation at Fulford Road special and open-air schools.—H. Mandefield.
Tramways Committee. Recommended :—
Welding joints.—Scholey Construction Co., Ltd.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, May 10th. Institution, Storey's Gate, S.W. 6 p.m. Special general meeting. To consider and, if thought fit, pass resolutions relative to a petition for a Royal Charter.
Tuesday, May 14th. 6 p.m. Annual general meeting.

Physical Society.—Friday, May 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

North-East Coast Exhibition.—Newcastle-on-Tyne. May 14th to October.

Illuminating Engineering Society.—Tuesday, May 14th. Home Office Industrial Museum, Horseferry Road, S.W. 6.45 p.m. Review of the proceedings of the International Commission on Illumination and on the International Congress held in the United States in 1928.

Physical Society and the Society of Glass Technology.—Tuesday, May 14th. Research Laboratories of the General Electric Co., Ltd., Wembley. 4 p.m. Special meeting.

World Power Conference.—Barcelona International Exhibition. May 15th to 23rd.

Royal Society of Arts.—Wednesday, May 15th. John Street, Adelphi, W.C. 8 p.m. "The Reform of the British Patent System." Mr. R. Burrell.

Overhead Lines Association.—Wednesday, May 15th. Institution of Electrical Engineers. 5.30 p.m. "Getting Consumers in Rural Areas." Lieut.-Col. W. A. Vignoles.

British Institute of Radiology incorporated with the Röntgen Society.—Thursday, May 16th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Institution of Electrical Engineers, Irish Centre (Dublin).—Thursday, May 16th. Trinity College, Dublin. 7.45 p.m. Annual general meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 18th. South Wales Institute of Engineers, Cardiff. 6 p.m. Annual meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

SOLARAY floodlights.
BLITZ pear switches (name of importer required).
Electrically-operated horses and camels for gymnasium use.
Lamp caps or bases.

Notes.

Extended Steam Tables.

With the assistance of the British Electrical and Allied Industries Research Association, it recently became possible to make direct measurements of the total heat of both water and steam at pressures up to 4,000 lb. per sq. in., and temperatures up to 750 deg. F. They included the whole of the critical region, in which no heat measurements had previously been made, and proved that the objection to the Joule-Thomson equation (namely, that it was incapable of representing the complex phenomena of the critical state) had no foundation in fact. The new experimental data proved to be quite inconsistent with the van der Waals theory, which had been universally accepted for more than fifty years, but fell naturally into line with the fundamental basis of the Joule-Thomson equation, as first applied to steam by Prof. H. L. Callendar in 1900. This fatal objection having been removed, a general account of the theory and equations, as applied to the critical state, was communicated to the Royal Society in 1928 and a set of skeleton steam tables, calculated from the modified equation, was forwarded to the Research Association at the same time. The tables have now been published with some additional details and explanations by the Institution of Mechanical Engineers. They are not intended to be final, but are reproduced as a basis for discussion and comparison, with the object of inviting criticism and suggestions from other workers.

The Battersea Power Station.

The general secretary, Mr. W. Arthur Jones, A.M.I.E.E., of the Electrical Power Engineers' Association, has issued a statement relative to some of the London daily newspapers' support of the objection that is being raised to the proposal of the London Power Company to erect a new power station at Battersea, which received, not only the consent of the Electricity Commissioners, but also that of the Office of Works, and the station has been adopted as a "selected" station by the Central Electricity Board. The objection is based on the fact that the combustion of coal at the proposed station will be on a large scale and "experience . . . indicates the emission of large quantities of sulphurous acids causing serious damage"; reference is further made to the discharge of large quantities of fine dust and grit. The latter complaint, the E.P.E.A. statement points out, certainly would not be relevant in the case of the installation suggested at Battersea. The emission of sulphurous fumes is a possibility no one would deny. At the same time, it should be appreciated that in a modern power station coal is consumed by scientific methods which aim, not only at getting the utmost heat value out of the coal, but of also dealing with the residue in the most efficient manner. The inaccuracy of the premise underlying the objection rests, however, not upon the method of coal combustion, but upon the assumption which appears to underlie the whole of the agitation, *viz.*, that the coal which is to be consumed at Battersea and in other power stations will be additional to the present consumption in the particular district. The consumption of the proposed station has been given as being an ultimate maximum of 2,000 tons daily, or an annual consumption of three-quarters of a million tons, which is probably overstated. The objectors appear to have completely overlooked the fact that the energy it represents will replace and abolish the hundreds of thousands of domestic coal fires which are daily emitting smoke, sulphurous acids, and various other detrimental products, into the atmosphere of London. The amount of coal being burnt in Greater London at the present time is of such proportions that the maximum rate of combustion at the proposed Battersea station becomes in comparison almost a mere bagatelle. During 1928 the amount of coal consumed in the Greater London area for domestic purposes, that is, excluding the amount used for semi-domestic purposes, such as bakeries, nurseries, &c., and also excluding that used for industrial purposes, was eight million tons. That coal, consumed as it is in a most inefficient manner, is at present emitting more than ten times the amount of sulphurous fumes alleged to be the maximum possible from the Battersea station. Looked at from this point of view, the compulsory abolition of the domestic coal fire becomes an urgent necessity. Pending, however, a Government sufficiently courageous to enact and enforce the necessary legislation, the concentration of combustion at the Battersea station, with scientific and efficient methods of operation, is a big step forward to this desirable end.

According to the latest returns of the Electricity Commissioners, the total amount of coal used by the Electricity supply industry throughout the United Kingdom for the year ended March 31st, 1928, was nine and a quarter million tons only. This one fact alone should convince the objectors and their supporters that their well-meant efforts are somewhat misdirected.

It is suggested by the objectors that, because of the prevailing winds, the proposed station should be placed in an eastern district of London, but it may be imagined that the military authorities would prefer that such generating stations, whose continued existence and operation would be so vital under circumstances of war, should not be placed in apparently close proximity, even though the width of the river may be between them. A further difficulty would arise in the necessity to bring the power trunk mains from the generating station placed lower down the river to the centre of distribution through streets and highways already congested with such impedimenta underground, and with an ever-increasing volume of traffic on the surface. It will be appreciated that whatever may be done on the Continent may, or may not, be suitable for the conditions which obtain in London. Does the opposition to the scheme realise that the solution proposed would not be in the national interests, however beneficial it may be to the south-western area of London? Electrical energy is not a luxury, but a necessity to all walks of life, and it is in the national interests that such energy should be generated and distributed in the most efficient manner possible. Even if the total emission of sulphur is unpreventable, which cannot for one moment be admitted, it is suggested that the advantages on the other side of the account would outweigh that particular defect, apart from the fact that such emission would be less than that obtaining at the present time. The elimination of sulphur is a problem which is not beyond the acumen of engineers and chemists to solve, and it contains the added incentive that by solving it they would not only meet the objections that have been made, but would also continue the process of taking us a step further towards the creation of a cleaner and healthier atmosphere. In the meantime, the man in the street should realise that the proposed station at Battersea, and the additional proposals to extend existing stations, will be a step in the same direction, by the provision of energy on an efficient and economic basis which will be in substitution of the present wasteful and air-polluting domestic coal fires.

Glasgow Royal Technical College Exhibition.

The triennial exhibition and reunion of students was held within the College on April 27th. The opening ceremony was performed by Mr. Robert Robertson, B.Sc., M.Inst.C.E., Lord Dean of Guild, vice-chairman of the Board of Governors of the College, in the presence of an audience of over 1,000. A unique opportunity was offered to the public to inspect the Institution under working conditions, special exhibits and demonstrations having been arranged by the students in all departments. In all, over 4,000 people attended the exhibition, the results being highly gratifying to the organisers. The profits will be devoted to the furtherance of sport and other student activities in the College.

Torquay Extensions.

At a cost of practically £120,000, the Torquay Corporation has made extensions to its electricity works situated at Newton Abbot, which were officially opened on May 1st by the Mayoress of Torquay (Mrs. C. Geen). Those present included representatives of local authorities who are served by the undertaking. The extensions comprise a 7,500-kW turbo alternator with surface condensing plant; a 50-ton electrically-driven engine-room crane; two high-pressure boilers with economisers, induced draught and other auxiliary plant; additional riverside works for the provision of circulating water for the condensers, a new railway siding for receiving supplies of coal from the G.W. Railway, and a system of coal-handling and conveying plant.

By means of the travelling engine-room crane the Mayoress was handed a bouquet at the outset of the proceedings.

Mr. John Taylor, chairman of the Electricity Committee of the Corporation, who extended a welcome to the assembly, said that since the opening of the plant at Newton Abbot there had been big development. Some four and a half years ago they sold four million kWh and their price at that time was an average of 4½d., he added. To-day they were selling sixteen million kWh and the price was 1½d. all in. The Committee decided not to appoint consulting engineers for the job, but to employ its own engineer. The station had been equipped at a cost of £10 per kilowatt, which was a price lower than anything in the West of England. The average price per kilowatt was about £14. The equipment was a costly business and the skill and experience which had been put into it was of a high order. On one side they could give their engineer (Mr. H. F. G. Woods) 50 per cent. full marks for administration and generation, and on the side of getting new business and pushing new business he gave him another 50 per cent. full marks; the Committee had trusted him in every way.

For many years, he continued, they had been reducing price all the time, and they were now told they were to be taken over at the end of the year by the Central Electricity Board. "They have promised the country cheaper electricity and we have given them a job that will take them all their time to give cheaper electricity than we are giving at the present time." In rural districts they had had a great deal to contend with, but they had got over most of the difficulties.

The Mayoress was presented with a cut-glass vase as a memento of the occasion, after she had set in motion the new turbo-alternator.

The Mayor (Mr. C. Geen) acknowledged the presentation to the Mayoress and, congratulating those who had brought the undertaking to so successful an issue, said it was an example of co-operation in municipal and local government such as might be of great advantage to them in the future. They had Torquay and Newton Abbot, their near neighbour Paignton, their other neighbour Teignmouth, and the other outlying districts all uniting together to make the undertaking a success, and it was a matter on which they could heartily congratulate themselves.

Those politicians who promised electricity for nothing, he concluded, had better provide it before the election, because the cost of distribution was such as to make it a speculative proposition as to what it would cost. They did not know what the Government would do with their station, but they believed it would further develop it in order to supply a larger area.

During the afternoon the party was conducted over the works by a number of guides, and tea was served.

The Electrical Association for Women.

The summer fixtures of the Electrical Association for Women (London) include the following: May 29th, lecture-demonstration with a thermal-storage electric cooker, by Mrs. H. Dover, B.Sc. (London), at 46, Kensington Court, W.8; June 6th, Women's Day at the Incorporated Municipal Electrical Association Convention at Torquay; June 12th, summer outing to Ashford (Kent) by invitation of the Ashford District Branch (motor coach will leave the Embankment, opposite Charing Cross Underground Station, where members are asked to meet at 10 a.m. prompt, and will return to London approximately at 10 p.m.); July 10th, 11th and 12th, E.A.W. Conference and annual general meeting at Newcastle-on-Tyne, by invitation of the North-East Coast Branch.

On April 25th, nearly 70 members of the Birmingham and Midlands Branch of the Association paid a visit to the needle factory of Messrs. Henry Milward & Sons, at Redditch. The factory is entirely electrically equipped, and the members marvelled at the great number of processes which a needle goes through before it is fit to be used.

I.E.E. Benevolent Fund Golf Competition.

The committee of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers has in the past organised two very successful golf competitions, and by that means has been able to hand over a substantial amount to the benevolent fund. This year, in place of the usual reunion, the committees of the Manchester and Liverpool Centres have decided that it should take the form of a golf competition and a reunion dinner. The competition, including the play for the G. P. Dennis trophy, will be held on May 29th, on the links of the Hesketh Golf Club, Southport, and that the dinner, to which ladies are invited, will be held at the Prince of Wales Hotel, Southport, and will be quite informal.

North-East Coast Exhibition.

Some fears have been expressed that inadequate arrangements have been made for the accommodation of the many thousands of visitors to the North-East Coast Exhibition at Newcastle-upon-Tyne, which is being formally opened by H.R.H. the Prince of Wales on Tuesday, May 14th. We are informed that this is not so; not only have very extensive arrangements been made in the city of Newcastle itself, but the Exhibition is situated within extremely easy reach of a large number of the attractive seaside and inland resorts, where excellent and extensive accommodation for an enormous number of visitors is available. There is a well-organised accommodation bureau at 31, Westgate Road, Newcastle-on-Tyne.

Radio at Sea.

Since the general adoption of wireless apparatus on board foreign trawlers frequenting the waters round Iceland, the number of vessels arrested for fishing in forbidden areas has become almost nil. It appears that the trawlers keep up constant communication with each other, but as the Icelandic authorities are never able to interpret the messages, which are frequently tapped, the conclusion arrived at is that the trawlers use a secret code, and that they would not do so if everything was fair and above board. The Iceland Minister of Justice has therefore brought a Bill before the Althing to compel all Icelandic trawlers to carry wireless apparatus. The sets will be under Government control, and all telegraphists will be obliged to record messages they succeed in taking; in addition, they will not be allowed to use codes that are not officially approved. The idea is apparently that trawlers are to keep an eye on each other, and so prevent any co-operation between Icelandic and foreign boats. Correspondence in an unknown code will be made an offence, and the Bill provides for fines up to 30,000 kroner.—*Reuters* (Copenhagen).

Reports received by the Marconi International Marine Communication Company from a number of steam trawlers on which its apparatus is installed indicate that its value is considerable. Units of fishing fleets have been enabled to communicate throughout their operations and, by exchanging reports of fishing conditions, to concentrate on the grounds found to be most profitable. In addition, by keeping in touch with the owners, trawler skippers have been enabled to obtain last-minute market reports and to land their catches at the ports where prices were most favourable. A very complete service of weather reports, independent fishing reports, and time signals, is made available by wireless, and these auxiliary services have on occasion proved of great value. Practically all Marconi-equipped trawlers carry ½-kW transmitters of the quenched-gap type, with two-valve receivers (type M.R.4C.) having a wave range of 200 to 3,000 metres, and so are able to communicate with other trawlers and with land stations over distances of from 200 to 300 miles and more. A number of trawlers are also fitted with direction finders and direction indicators, which are an invaluable aid to navigation and, in addition, enable a vessel, when called to any particular fishing ground by a sister-ship, to proceed directly there by following the bearing of the calling transmitter.

Radio Picture Transmission.

Owners of Fultographs will very soon be able to receive pictures from many countries in Europe. Captain Fulton has returned from an European tour during which he concluded arrangements with the German authorities for regular transmissions during programme hours to take place from many radio broadcasting stations in that country. The new German transmissions began on May 1st and the service will be rapidly increased. In Central Europe the big stations at Prague and Budapest are also installing photo-electric Fultograph transmitters; their transmissions are to begin on May 15th. Southern Europe is also to send us still pictures, for Rome, Madrid, and Barcelona are inaugurating services almost immediately. Brussels, whose new 10-kilowatt transmitter provides such good reception in this country, is acquiring still-picture transmitting plant, whilst both Hilversum and Radio-Paris will soon have their regular services in operation; 5XX, Hilversum, and Radio-Paris are "daylight" stations, and 5GB, 2LO, and Vienna provide after-dark picture services.

On April 23rd an unusual service for ships was inaugurated. Messages were sent and received, not by means of morse dots and dashes, but also in facsimile typewriting. At the Rugby station of the G.P.O. lists of Stock Exchange quotations typewritten on thin paper were mounted one by one upon the transmitting apparatus. Three ships, the *Orvieto*, the *Avilla* and the *Minnewaska*, have been fitted with picture-receiving apparatus and with special wireless sets designed for the purpose by the Marconi International Marine Communication Co., Ltd. Aboard them, on the high seas, the typewritten lists were received, ready to be pinned to the bulletin board. Experiments have shown that at ranges of thousands of miles ordinary typescript is received by means of the Fultograph with clearness and legibility. The Wireless Press, Ltd., supplies news to ships at sea, and Wireless Pictures, Ltd., are responsible for the transmitting and receiving apparatus.

C.E.B. Report.

On going to press we learned of the publication of the first annual report of the Central Electricity Board. Copies are obtainable (price 2s. 6d. each, 3s. post free) from Messrs. Whitehead Morris, Ltd., Tower House, Holland Street, London, S.E.1, or through any bookseller.

B.B.S. for Mining-type Transformers.

The British Engineering Standards Association has just issued a British Standard Specification for mining-type transformers (No. 355-1929), this being the first of a series of specifications that are in the course of preparation for mining electrical apparatus by the colliery section. This specification applies to oil-immersed naturally-cooled transformers primarily for use underground in collieries, and, whilst no stipulation is made on flameproofness as an essential requirement, it includes the necessary constructional provisions to satisfy the requirements of the Coal Mines Acts underground in collieries. The provisions of B.S. Specification No. 171, Electrical Performance of Transformers for Power and Lighting, are embodied. Maximum overall dimensions for three sizes of transformers, 100 kVA, 200 kVA and 300 kVA, have been included in order to assist colliery managers and engineers in the installation of transformers underground. The Colliery Electrical Section has also in the course of preparation specifications for mining-type motors and generators, flameproof switches and circuit breakers, miners' hand-lamp bulbs, underground lighting fittings and cable glands and sealing boxes. Copies of the new Specification can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free

Appointments Vacant.

Teachers of electrical drawing and electrical wiring for the L.C.C. junior technical officer in the Admiralty Technical Pool at Portsmouth. Examiner at Aeronautical Inspection Department, Kidbrooke, S.E., for the Air Ministry. Resident engineer (£750) for Government of Nigeria. Commercial assistant (£350) for Scarborough Corporation Electricity Department. Chief electrical engineer for Nigerian Electricity Supply Corporation, Ltd. Mains assistant (£300) for Horsham Urban District Council. Electrical engineer (£200) for the Newcastle Emlyn and District Electric Supply Co., Ltd. (See our advertisement pages to-day.)

Large Telephone Cables.

One of the most noteworthy of recent developments in telephony is the 1,800-pair cable, containing 3,636 separate wires, now coming into regular use in the Bell system. The new cable is the result of the use of smaller wire, No. 26, which is 0.0159 in. in diameter, or approximately half the diameter of an ordinary pin. Other factors are the "multiple-unit" arrangement of the wires and the use of thinner paper for insulation, the latter necessitating the perfection of machines that would apply the thinner paper without breaking it, says *The Times Trade and Engineering Supplement*. In the 1,212-pair cable, which was the previous holder of the title for the largest number of pairs, as well as in the smaller sizes, the wires were spiraled on in layers until the proper number was reached. A cross-section of this type therefore resembles a cross-section of a tree with circular rings. The multiple-unit structure, however, is made up of a number of component units. The 1,818-pair cable consists of eighteen such units, or groups of wires, each having 101 pairs, which are twisted together to form the cable. A new colour scheme has been worked out for the paper used in wrapping the individual wires, so that each of the eighteen units can be definitely identified at any point along a cable route. In each of the units in the new cable 100 pairs are the same colour and one pair, which is called a "tracer" and is for special use of the cable service, is red-blue. Each unit receives its name from the colour of the 100 pairs, being known as a blue-green, a red-white, or a red-green unit. Of the eighteen units in this cable nine are blue-white, six are red-white, and three are red-green, one of the last being placed in each of the three layers of units in the cable. Thus the identity of every unit can be indicated by giving its relation to the red-green unit in the same layer. By placing the three red-green units in a line with each other from the centre to the edge of the cable and arranging the other units symmetically on both sides of this line, it becomes possible always to join units of the same colour without interweaving among each other at the splice. Further, with this colour scheme, one end of a length of cable can be spliced to either end of another length, thus retaining the desired "flexibility" of the previous type of cable.

Educational.

The summer evening classes of the Manchester Municipal College of Technology will begin on June 3rd and 4th and continue till July 23rd. The subjects to be dealt with by the Electrical Engineering Department (head: Prof. Miles Walker) are the improvement of power factor, electricity meter testing, a.c. wave shapes and harmonic analysis, switchgear for mines, electrical laboratories and wireless laboratory.

Institution Notes.

Institution of Electrical Engineers.

WESTERN CENTRE.—Following a peculiar windstorm at the end of October, 1927, which caused much trouble on overhead lines, Dr. G. C. Simpson, F.R.S., of the Meteorological Office, London, lectured on atmospheric electricity in March of last year. Arising out of that lecture he was invited to deliver the Kelvin Lecture before the Western Centre on April 29th at Cardiff, an unusual procedure. The audience over-filled the theatre and many had to stand. A vote of thanks was proposed by the chairman, Mr. W. J. Bache, and seconded by Mr. W. O'Connor, F.G.S., first past-president, South Wales Institute of Engineers.

The Physical Society.

A joint meeting of the Physical Society and the Society of Glass Technology will be held on May 14th, 1929, by permission of the company and of the director of its laboratories, Mr. C. C. Paterson, at the Research Laboratories of the General Electric Co., Ltd., at Wembley. Visits to the laboratories and to the neighbouring glass works of the General Electric Co. are being arranged.

Royal Institution.

The annual meeting was held on May 1st, Sir Arthur Keith, treasurer and vice-president, being in the chair. The annual report of the Committee of Visitors for 1928, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. The report of the Davy-Faraday Research Laboratory Committee was also read; 60 new members were elected in 1928, and 64 lectures and 19 evening discourses were delivered. The books and pamphlets presented amounted to about 181 volumes, making, with the 712 volumes (including periodicals bound) purchased by the managers, a total of 893 volumes added to the library in the year. The following gentlemen were unanimously elected officers for the ensuing year—*President:* the Duke of Northumberland; *treasurer:* Sir Robert Robertson; *secretary:* Major Charles E. S. Phillips; *managers:* Lord Blanesburgh, Ernest Clarke, Sir James Crichton-Browne, Frederick G. Dennan, W. H. Eccles, W. Vaux Ginham, J. S. Highfield, Sir Arthur Keith, V. Warren Low, Charles H. Merz, Robert Mond, Sir Richard Paget, C. C. Paterson, George C. Simpson and W. J. Tennant. *Visitors:* M. Atkinson Adam, Edward N. da C. Andrade, James H. Batty, Frederick H. Berryman, Montague Ellis, Kenneth R. Hay, David Heron, G. W. C. Kaye, William Macnab, Emile S. Mond, Hugh Munro Ross, Walter S. Rowntree, Sidney Skinner, Harold R. D. Spitta and Alfred E. Western.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. A. C. MORGAN, secretary to the Technical Management at the Belvedere works of Callender's Cable & Construction Co., Ltd., who is taking up an important position in London, has been presented by his colleagues with an inscribed gold watch. Mr. Morgan has been on Callender's staff for 22 years.

Mr. D. WILLIAMS, of the Leicester Corporation Electricity Department, has been appointed consumers' engineer at the Rugby electricity works, at a salary of £5 5s. per week. He succeeds Mr. B. M. Butler, who has resigned.

Mr. A. W. MAKOVSKI, of Tamplin & Makovski, Ltd., Redhill, has been re-elected president of the Reigate and Redhill Chamber of Commerce.

Mr. A. H. DARKER, chief electrical engineer of Messrs. J. Stone & Co., Ltd., who has been making a world tour, is returning to London from Australia and New Zealand by the *Orama* on June 6th.

SIR JAMES A. COOPER has been appointed a director of Vickers-Armstrongs, Ltd.

Mr. R. LOMAX informs us that his recent resignation from the position of borough electrical engineer of Stockport was prompted by a suggestion that he should agree to a heavy reduction of salary. A public statement has been made on behalf of a member of the Town Council that remarks made at a Council meeting were not in any way intended to reflect upon Mr. Lomax's skill or ability.

At the April meeting of the Council of the E.C.A. Allied Associations, Mr. H. WILLOUGHBY ELLIS, A.M.I.E.E. (Messrs. Ellis & Ward, Ltd.), was nominated as president of the Association for the year 1929-30. Mr. H. C. HAZEL, M.I.E.E. (Messrs. Lindsay & Co., Liverpool), was nominated vice-president.

Mr. P. E. JOHNSON, who has been appointed assistant mains engineer at Leamington, was recently presented with an oak writing desk by the staff of the Aylesbury electricity works.

Mr. GEORGE A. GAHAN has been appointed, at £2,000 per annum, to succeed Mr. N. G. Bell as Commonwealth Railways Commissioner. Mr. Gahan is at present chief engineer to the Commonwealth Railways, a member of the Australian Institute of Engineers, and senior officer in the Commonwealth Railways Service. He was sent abroad by the Australian Government in 1926 to obtain information on engineering and general railway matters. He studied modern railway practice in the United States, Great Britain, and the Continent. According to the *Industrial Australian*, he will be acting commissioner from May till November, during the period that Mr. Bell will be on furlough, and thereafter will be appointed as commissioner for a term of five years.

At last week's meeting of the Sheffield City Council, regret was expressed at Mr. FEDDEN'S resignation from the post of city electrical engineer, but the chairmen of the Electricity and Tramways Committees extended their congratulations to him upon his appointment as district engineer for the Mid-East England Electricity Scheme. At the same meeting a letter from the Associated Municipal Electrical Engineers was read in which it was maintained that the salary offered to Mr. Fedden's successor (£1,250) was far too low. According to the A.M.E.E. scale the salary for the engineer of an undertaking with an output of 100 million kWh was £2,255; Sheffield's output was now 198 million kWh. The letter was referred to the Electricity Committee for consideration.

A proposal to increase the salary of the Prestatyn electrical engineer (Mr. W. R. KELLEY) from £325 to £400 a year was referred back at a recent meeting of the Urban District Council.

The Lord President of the Council has appointed Sir JAMES A. EWING, K.C.B., LL.D., &c., to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, to fill the vacancy occasioned by the death of Mr. R. W. Reid, C.B.E. Sir Alfred Ewing was recently elected an honorary member of the Institution of Civil Engineers.

Mr. A. F. STEVENSON, Glasgow, has taken up a position as representative with Derby Cables, Ltd. He is to continue the technical associations with which he has been connected for many years in Scotland.

Mr. H. E. SEWELL, who was for 26 years works manager of the Macintosh Cable Co., Ltd., is now the general manager of Derby Cables, Ltd., referred to in another part of this issue.

Mr. L. J. RANSOM was presented recently with a gold watch by his colleagues on relinquishing his position as production manager with the Liverpool Electric Cable Co., Ltd., to become works manager with Derby Cables, Ltd. Mr. Ransom was previously, for a number of years, with the Hackbridge Cable Co., Ltd.

The Torquay Electricity Committee recommends the payment of 500 guineas to the engineer, Mr. H. F. G. WOODS, for the special services which he has rendered as consulting engineer in connection with the extension of the generating station at Newton Abbot and the installation of additional plant.

Mr. ANDREW BAILES has resigned his position as secretary and sales manager to Omega Lampworks, Ltd., to take up other employment.

Last week Mr. A. E. APPS was presented with an engraved silver cigarette box by the staff and employés of the London and South of England branch of Simplex Conduits, Ltd., on his retiring from the post of sales representative which he has occupied for the last 18 years. Mr. Apps is taking up an engagement in the sales department of Millars Machinery Co., Ltd.

Mr. W. H. SPEEDY has left the Newport (Mon.) Electricity Department upon appointment as shift engineer at the Darwen electricity works.

M. ALBERT CANCE, president of the Syndicat Général des Installateurs Electriciens, has lately been appointed an officer of the French Legion of Honour.

Obituary.—M. J. BOUSSINESQ.—The death recently occurred in Paris, at the age of 87 years, of M. Joseph Boussinesq, a leading French authority on hydro-dynamics and the utilisation of water power.

PROF. B. DONATH.—The death occurred recently, in Berlin, at the age of 56 years, following an operation, of Prof. Dr. Bruno Donath, the director of the physical and electric rectifier department of the Accumulatoren Fabrik Gesellschaft of that city.

SIR PERCY K. STOTHERT.—We regret to learn of the death at Bath on Monday last of Sir Percy Kendall Stothert, K.B.E., chairman of Stothert & Pitt, Ltd., crane makers. He was 66 years of age.

Wills.—The late Mr. O. C. HAWKES, of O. C. Hawkes, Ltd., of Birmingham, left £257,459 gross and £253,099 net personalty.

The late Dr. CHARLES S. DU RICHE PRELLER, M.I.E.E., left personal estate in Great Britain valued at £71,651.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Derby Cables, Ltd.—Registered as a private company April 30th. Capital, £100,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in cables, insulating materials of all kinds, lifting appliances, &c. The directors are:—C. A. Newton (chairman), Park Lane House, Littleover, Derby; J. H. Lord, address not stated; H. Newton, Mile Ash, Derby; H. B. Potter, address not stated; F. Newton (managing director), The Grange, Old Normanton, Derby. Secretary: E. A. Swindall. Solicitors: Flint, Marsden & Bishop, Derby.

Young Accumulator Co. (1929), Ltd.—Registered as a public company May 1st. Capital, £225,000 in 10s. shares. Objects: To acquire the undertaking and all or part of the assets of the Young Accumulator Co., Ltd. (including its rights in respect of the British Empire, excluding Canada) in a process used in connection with the manufacture of electrical accumulators, and to carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, &c. The directors are:—E. H. F. Reeves, Field House, Friern Park, N.12 (director Crompton Parkinson, Ltd., and Electric Supply Corporation, Ltd.); J. L. Wilson, 68, Vineyard Hill Road, S.W.19; L. Roney, 24, Gerald Road, Eaton Square, S.W.1; T. E. Eachus, O.B.E., Fox Rock, Hertford; A. W. Bullivant, 78, Campden Hill Court, W.8. Registered office: 4, Drapers Gardens, E.C.2.

Tri-Signs, Ltd.—Private company. Registered May 1st. Capital, £600 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical illuminated and other devices, signs and signals, for advertising or otherwise, &c. The subscribers (each with one share) are:—R. E. Haykin, 64, Lower Hastings Street, Leicester, advertising specialist; F. Simkin, 16, New Street, Leicester, incorporated accountant. R. E. Haykin is permanent managing director and chairman. Qualification, £100. Secretary: F. Simkin.

Chesham and District Electrical Installation Co., Ltd.—Private company. Registered May 1st. Capital, £100 in £1 shares. Objects: To carry on the business indicated by the title. The directors are:—G. A. Wilkinson, Yer Cot, Bois Moor, Chesham Bois, Bucks; A. Mayger, Ferndale Villas, Severalls Avenue, Chesham Bois. Secretary: F. W. E. King. Registered office: 111, High Street, Chesham, Bucks.

Carlton Radio Co., Ltd.—Private company. Registered April 27th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, gramophones, pianos, &c. The subscribers (each with one share) are:—H. R. Bettinson, 36, Cannon Street, Birmingham, solicitor; G. M. Butts, 36, Cannon Street, Birmingham, solicitor's managing clerk. Solicitors: Forsyth, Bettinson & Co., 36, Cannon Street, Birmingham.

United Africa Co., Ltd.—Registered as a private company April 29th. Capital, £13,000,000 in £1 shares. Objects: To acquire and amalgamate all or part of the undertakings, businesses, properties, and assets of the African and Eastern Trade Corporation, Ltd., and the Niger Company, Ltd.; to enter into two agreements with those companies; to acquire concessions, territories, lands, rights, &c.; to build, maintain and work roads, railways, tramways, telegraph lines, telephones, electricity works, wharves, docks, ships, &c. The subscribers are the African and Eastern Trade Corporation, Ltd., Liverpool (A. Stephenson, secretary), and the Niger Co., Ltd. Registered office: Africa House, Kingsway, W.C.2.

Gould, Harper & Co., Ltd.—Private company. Registered April 26th. Capital, £2,000 in 5s. shares. Objects: To acquire the business of manufacturers of wireless and electrical apparatus now carried on by C. H. Gould and T. Harper at Tatnam Road, Poole, Dorset, as "Gould, Harper & Co." The permanent directors are:—C. H. Gould, "La Estancia," Tatnam Road, Poole; T. Harper, 5, Pine Avenue, West Southbourne, Hants; J. P. Wills, 34, St. Margaret's Road, Poole. Solicitor: W. Hatton, Budge, Poole.

Bushing Co., Ltd.—Registered as a private company April 27th. Capital, £60,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in insulating materials and articles and products, electrical, mechanical or general engineers, &c. The subscribers (each with one share) are:—H. W. Miller, 1, Windsor Crescent, Newcastle-on-Tyne, engineer; H. M. Towns, Kenilworth, Kenton Avenue, Gosforth, Newcastle-on-Tyne, company secretary. Solicitors: Watson, Burton, Booth & Robinson, Pilgrim House, Newcastle-on-Tyne.

Thornbury and District Electricity Co., Ltd.—Public company. Registered April 27th. Capital, £15,000 in £1 shares. Objects: To acquire the business of an electricity undertaking carried on by F. H. Grace at Thornbury, Glos., and his rights and privileges under the Thornbury and District Electricity Special Order, and to carry on the business of an electric light company in all its branches. Purchase consideration £4,400 in shares. Minimum cash subscription, £4,000. The first directors are:—E. Cullimore, Shen, Gloucester Road, Thornbury, timber merchant; F. H. Grace, West Shen, Gloucester Road, Thornbury, electrical engineer; Helen G. Grace, West Shen, Gloucester Road, Thornbury (director of Thornbury Gas Light & Coke Co., Ltd.). Solicitors: Crossman & Co., Thornbury, Glos.

Stone Manufacturing Co., Ltd.—Private company. Registered April 22nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric batteries, electric lamps and torches, hand, cycle, and other lamps, electrical instruments and novelties, &c. The directors are:—G. F. A. Stone (permanent managing director), 422, Pinner Road, Harrow; Miss Ethel Payne, 204, The Grove, Hammersmith, W.6. Registered office: 108-109, Great Saffron Hill, E.C.1.

Supra Electra Motors, Ltd.—Private company. Registered April 27th. Capital, £10,000 in £1 shares. Objects: To carry on business as manufacturers and distributors of and dealers in electric motors and all kinds of machinery and apparatus, &c. The first directors are:—J. Sinclair-Ross, 1, Morpeth Terrace, Westminster, S.W.1, engineer; C. V. Berggren, Woodlands, St. John's Road, Orpington, cargo superintendent (life directors).

Multiple Frequencies, Ltd.—Private company. Registered May 2nd. Capital, £100 in 1s. shares. Objects:—To develop inventions, patents, rights, processes and businesses in connection with the gramophone and radio and sound reproduction machines and industries, &c. The directors are:—W. C. Bailey, 30a, Woodcote Grove Road, Coulsdon, Surrey, inventor; J. Keefe, Eastney, Buckhurst Hill, Essex (director of Steel Grip Fittings, Ltd.). Registered office: 10, St. Christopher Place, Wigmore Street, W.1.

Official Returns of Electrical Companies.

E. A. Manufacturing Co., Ltd.—P. H. Stone, 47, Temple Row, Birmingham, was appointed receiver and manager on April 19th, 1929, under powers contained in debentures dated September 16th, 1927.

L. Jacobs (London), Ltd.—W. S. Warren, 8-9, Martin Lane, E.C.4, ceased to act as receiver or manager on April 12th, 1929.

Lincoln Wireless Co., Ltd.—Capital, £1,200 in £1 shares. Return dated December 19th, 1928. 700 shares taken up. £700 paid. Mortgages and charges, nil.

Ferryside Electric Supply Co., Ltd.—Capital, £1,200 in £1 shares. Return dated December 31st, 1928. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Leamington and Warwick Electrical Co., Ltd.—Capital, £100,000 in 2,500 preference and 7,500 ordinary shares of £10 each. Return dated March 5th, 1929. All shares taken up. £100,000 paid. Mortgages and charges, £35,000.

Detex Distributors, Ltd.—Capital, £2,000 in £1 shares. Return dated July 25th, 1928. 881 shares taken up. £631 paid. £250 considered as paid. Mortgages and charges, nil.

Pan-Electric, Ltd.—Capital, £200 in £1 shares. Return dated January 1st, 1929. All shares taken up. £196 paid. £4 considered as paid. Mortgages and charges, nil.

Aland & Co., Ltd.—Capital, £3,500 in £1 shares. Return dated December 31st, 1928. 3,246 shares taken up. £752 paid. £2,494 considered as paid. Mortgages and charges, nil.

Ashley Wireless Telephone Co. (1925), Ltd.—Capital, £2,500 in £1 shares. Return dated December 31st, 1928. All shares taken up. £2,500 paid. Mortgages and charges, nil.

Forest City Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 13th, 1929. All shares taken up. £2,210 paid. £2,790 considered as paid. Mortgages and charges, nil.

Walter Denis Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated December 28th, 1928. 261 shares taken up. £2 paid. £259 considered as paid. Mortgages and charges, £1,850.

Berry, Wiggins & Co., Ltd.—Satisfaction in full on February 25th, 1929, of mortgage dated February 1st, 1924, securing all moneys due or to become due from the company to the Midland Bank, Ltd. (Notice filed April 26th.)

Ross, Courtney & Co., Ltd.—Deposit on April 16th, 1929, of deeds of 25, Ashbrook Road, and 62-4-6-8, Elthorne Road, Upper Holloway, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Radio Electric Co. (Bournemouth), Ltd.—Debenture dated April 6th, 1929, to secure £400, charged on the company's property, present and future, including uncalled capital. Holders: A. G. Smith, 16, Rushton Crescent, Bournemouth, and G. T. Smith, 67, Abbey Road, St. John's Wood, N.W.8.

Thermionics, Ltd. (formerly G.W.I. Valves, Ltd.).—L. A. Bartlett, 639-643, Salisbury House, London Wall, E.C.2, ceased to act as receiver or manager on April 12th, 1929.

Banting & Tresilian, Ltd.—Capital, £1,000 in £1 shares. Return dated January 2nd, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

E. P. Allam & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated March 6th, 1929. 5,000 shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

Westminster Electric Supply Corporation, Ltd.—Capital, £2,000,000 in 1,450,000 ordinary and 550,000 preference shares of £1 each. Return dated March 13th, 1929. 1,259,366 ordinary and 550,000 preference shares taken up. £1,305,620 paid on 755,620 ordinary and 550,000 preference shares. £503,746 considered as paid on 503,746 ordinary shares. Mortgages and charges, nil.

Perfect Burglar Alarm Co., Ltd.—Capital, £4,000 in 1,000 preference and 3,000 ordinary shares of £1 each. Return dated November 26th, 1928. 230 preference and 1,710 ordinary shares taken up. £1,382 paid (being £1 per share on 1,210 ordinary and 15s. per share on 230 preference shares). £500 considered as paid on 500 ordinary shares. Mortgages and charges, nil.

Lancashire United Transport & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated March 14th, 1929. 192,878 shares taken up. £7 paid. £192,871 considered as paid. Mortgages and charges, £541,150*; £83,330 deferred debenture stock issued having no charge over the assets of the company. (* A further £50,000 of this stock has been deposited as security for possible advance.)

Electro-Mechanical Brake Co., Ltd.—Capital, £30,000 in 2,500 preference and 27,500 ordinary shares of £1 each. Return dated November 5th, 1928 (filed March 4th, 1929). 1,500 preference and 26,500 ordinary shares taken up. £21,965 paid on 1,500 preference and 20,465 ordinary shares. £6,035 considered as paid on the remainder. Mortgages and charges, £7,500.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated February 18th, 1929. All shares taken up. £3,980 paid. £1,020 considered as paid. Mortgages and charges, £1,266 6s. 2d.

Lamp Manufacturing Co., Ltd.—Capital, £10,000 in £1 shares. Return dated February 14th, 1929. 5,400 shares taken up. £5,400 paid. Mortgages and charges, £2,500 debentures.

Electric Art Shades (1928), Ltd.—Satisfaction to the extent of £50 on March 29th, 1929, of debenture dated August 22nd, 1928, securing £250.

J. T. Kemp, Ltd.—R. B. Baggaley, C.A., Commerce Chambers, Parliament Street, Nottingham, was appointed receiver on April 23rd, 1929, under powers contained in debentures authorised September 23rd, 1927.

City Notes.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.

The annual meeting was held on April 30th, Mr. E. Garcke (chairman) presiding. In presenting the report and accounts, the chairman said that it was natural to expect that the general development of the company's business would cause an increase in expenses, but he must draw attention to the large increase in the amount paid in rates. In 1928 it paid £24,156, as against £16,178 in the previous year and £14,103 the year before. The position would not be eased by the De-Rating Act, as public utilities were debarred from obtaining any advantage from its provisions. Arrangements for inter-connection of supply had been made with the City of Birmingham on the east of the area and with the West Gloucestershire Power Co. and Wessex Electricity Co. on the south. Negotiations with similar objects were proceeding with the Hereford Corporation on the west and with the West Midlands Joint Electricity Authority on the north. The company was also supplying electricity in bulk to the Corporation of Cheltenham. Its distribution area covered nearly the whole of the County of Worcestershire, considerable portions of Staffordshire, Shropshire, Gloucestershire, Warwickshire, Herefordshire, and Oxfordshire, giving a total area of approximately 1,800 square miles in parts of seven counties. Within that area it had a number of separate electricity undertakings. In addition to those previously reported there were Banbury, Ledbury, Stratford-on-Avon, Shipston-on-Stour, and Church Stretton. The company had established an estates department, which was in a position to provide information concerning sites and availability of labour to industrialists in search of the most economic conditions for enterprise, including the supply of cheap electricity. The report and accounts were adopted and a resolution was passed creating 350,000 new shares of £1 each, to be called 6 per cent. cumulative preference shares.

Anglo-Portuguese Telephone Co., Ltd.

This company's report for 1928 was reviewed in our issue of April 26th (p. 753). The annual meeting took place on April 30th, when Sir Alexander Roger, the chairman, said that they had added substantially to the reserves, having created a general reserve of £25,000 and placed £14,580 to the renewals reserve. The capital expenditure had increased by £117,097, which reflected the fact that a telephone company could only progress by the continued expansion of its services and the addition of new equipment. The profit had shown a substantial improvement, for operating and other charges had materially decreased. The number of stations increased by about 9 per cent. during the year, but they hoped to improve upon that rate of progress. They had been able to borrow money on favourable terms from an associated company. When the loans reached a substantial sum it was their intention to issue fresh capital on terms favourable to the shareholders. The Government had granted them a new concession, and had asked them to consider an alternative basis of charging to the message rate system. They had agreed to this, and new rates were put into force in September last. The plant was modern and in good condition, but it was intended to replace it by automatic equipment when it was economic to do so. Upon a recent visit to Portugal he (the chairman) was favourably impressed with the possibilities of development. The telephone business in the country undoubtedly had a prosperous future. The company's relations with the Government and with the Municipalities of Lisbon and Oporto had continued on a very friendly basis. The chairman concluded by thanking the general manager and his staff for the heavy work which they had done during the past year.

Brush Electrical Engineering Co., Ltd.

The accounts for the year ended December 31st last show a net profit of £67,406 (against £65,510), after making provision for general charges, debenture interest, depreciation, &c. This is allocated as follows: To general reserve, £6,010; dividend of 10 per cent. on the shares, £47,640 (the same); further 4 per cent. interest on the participating second debenture stock, £2,045 (as for 1927); and surplus for apportionment between shareholders and co-partners, £11,711. The last sum has been allocated under the co-partnership deed in the following way: Co-partners, £9,839; shareholders, £1,873. The latter amount has been added to the undivided profits account, which now stands at £82,817. The total surplus included in this account is £6,626, and it is proposed to distribute from this 1 per cent., free of tax, in shares or cash, to the shareholders. In order to make this distribution in the most appropriate way it is proposed to convert the issued shares into stock and to alter the articles of association to enable the directors to deal with any future distribution of surplus in a similar manner. The issued share capital of the company now stands at £476,401, having been increased during the year by the allotment of 6,950 shares at par to

co-partners in respect of the 1927 surplus. The report says that the severe competition in the engineering industry shows no signs yet of diminishing. The company was fortunate, however, in having most of its shops well occupied during the year. Meeting: May 13th.

Oriental Telephone and Electric Co., Ltd.

The net revenue for the year ended December 31st, 1928, was £89,551, as compared with £72,119 in 1927. With £25,243 brought forward, and deducting interim dividends, there is an available balance of £91,029. The final ordinary dividend is 8 per cent., free of tax, making 12 per cent. for the year. For 1927 the dividend was 10 per cent., and there was a bonus of 2 per cent. The reserve receives £15,680, and £34,425 is carried forward. The report says that the installation of the new automatic exchanges in Singapore is well in hand, and should be completed early next year. A new scale of rates was instituted in Mauritius; some subscribers gave up their lines, but it is expected that they will return when they realise the equity of the new rates. The Bombay Telephone Co. reports further progress; the directors propose a dividend of 4 per cent. for 1928. The Bengal Telephone Corporation also shows satisfactory progress, and has again declared a dividend of 7½ per cent., free of Indian income tax. The Madras Telephone Co. reports marked improvement, and has maintained its dividend at 8 per cent., free of Indian tax. The Rangoon Telephone Co. has raised its dividend from 5 to 6 per cent. (free of Indian tax), and 8 per cent. has been paid on the shares of the Hongkong Telephone Co. The China and Japan Telephone & Electric Co. has again been able to declare a dividend of 15 per cent., free of income tax. Meeting: May 14th.

Calcutta Electric Supply Corporation, Ltd.

The report for the year ended December 31st, 1928, records the death of two directors—Mr. P. V. Luke and Maj.-Gen. R. H. Mahon. The sale of energy rose from 129,090,227 to 147,957,366 kWh, and the gross revenue from £930,291 to £955,129. After providing for depreciation there is a net profit of £401,803, as compared with £398,588 in 1927. The addition of £47,683 brought forward makes available £449,486. The allocations include £75,000 to reserve (against £70,000) and £22,551 "reserved for distribution to consumers." The report says that the latter sum is intended to enable the domestic consumers to participate in the profits of a successful year; details of the scheme are to be laid before the shareholders. The amount is equal to the bonus of 4d. per share which is being paid on the ordinary shares, in addition to the 12 per cent. dividend (final 7 per cent.). A balance of £41,130 is carried forward. The ordinary shareholders continue to receive the benefit of the relief in respect of Indian taxation, the deduction for income tax from the dividend and bonus for the past year being at the rate of 2s. in the £. The preference dividend is paid free of both Indian and British income tax. Sir James Donald, C.S.I., C.I.E., has joined the board. The meeting was to be held on Wednesday last.

At the meeting it was to be proposed that the capital should be raised to £4,000,000 by the creation of 1,000,000 shares of £1 each to be issued at the discretion of the directors.

Shanghai Electric Construction Co., Ltd.

The annual meeting of this company was held on May 1st. Mr. J. S. Haskell, the chairman, presided and in moving the adoption of the report and accounts (*vide* our last issue, p. 798), he said that it showed a remarkable recovery from the difficult and uncertain conditions which prevailed during the Chinese disturbances. This stage had been reached by the slow recovery of traffic and the company's policy of providing for wear and tear out of profits. They had spent a sum largely in excess of the issued capital of £500,000 and to bring the capitalisation more nearly into harmony with the value and extent of the undertaking the directors proposed to increase the capital and pay it up from the reserve. After referring to the improvement in the business of the Singapore Traction Co., the chairman said that they were adding £25,000 to reserve, and they proposed to continue, as profits permitted, the policy of adding to their financial resources from within rather than by raising fresh capital. It was proposed to capitalise £100,000 of the reserve and distribute it in the proportion of one new share for each five shares already held. The new shares would rank *pari passu* with the old ones, except as regarded the dividend to be declared that day. The increase of the capital to £700,000 would leave 100,000 shares to be issued if and when required.

The report and accounts were adopted and the capitalisation proposals approved.

Prospectus.

Young Accumulator Co. (1929), *Ltd.*—The registration of this company is recorded in the "New Companies" section of this issue. On Tuesday last the company published a prospectus offering for subscription 300,000 ordinary shares of 10s. each at par. The company is acquiring the business of the Young Accumulator Co., Ltd., including the rights for the British Empire (excluding Canada) in a process for making non-sulphating paste for electric batteries. It is also acquiring from Mr. Horace de Martis the rights in the process for the rest of the world. The consideration is the balance of the shares (150,000) and £10,000 in cash, and the company also undertakes to discharge the vendor company's liabilities surplus to assets up to £26,000. The prospectus stated that the Young accumulator possesses a number of qualities which render it superior to other makes. No figures relating to the past working of the vendor company were included in the prospectus, as "in view of the experimental stage through which it has been passing, these would be of little value." The company expects to spend £20,000 upon additional plant and machinery, and to have £68,000 available as working capital.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on May 3rd, and Lord Erskine, who presided in the absence of Sir Harry Renwick (chairman), read the chairman's speech. The chairman said that there was an increase in the electrical energy sold of 1,128,753 kWh, making the total 13,366,746 kWh for the year. Negotiations had been opened with the local authorities for extension of tenure of the company's undertaking, but settlement had not yet been reached. Controlling interests had been acquired in other supply undertakings, and two Orders were pending for Wimborne and district. A site had been purchased at Hamworthy, in the Poole area, and application was being made for sanction to erect a new generating station on that site. Meanwhile extensions were being made to the power station at Bourne Valley. Bulk supplies were being given to New Milton and Burton-on-Sea. For the first three months of the current year there was an increase in the electricity sold of over 18 per cent. The report and accounts were adopted.

Madras Electric Tramways (1904), Ltd.

The gross profit for 1928 was £29,099, as compared with £15,197 in the preceding year. After meeting interest and London office expenses, and transferring £7,500 to depreciation and renewal account, there was a balance of £12,212 (£1,025), plus £2,191 brought forward. The preference dividend, less tax, absorbed £6,000, and it is recommended that the balance of the cost of the issue of the 5½ per cent. (registered) debentures (£6,700) be written off, leaving £1,703 to be carried forward. In consequence of lower fares and the introduction of season tickets, the number of passengers carried showed a large increase on 1927, with a resultant increase in traffic receipts and net revenue.

John Thompson, Ltd.

The annual meetings of the associated companies of John Thompson, Ltd., of Wolverhampton, comprising John Thompson (Wolverhampton), Ltd., John Thompson Water Tube Boilers, Ltd., John Thompson Motor Pressings, Ltd., John Thompson (Dudley), Ltd., John Thompson Beacon Windows, Ltd., and Kennicott Water Softener Co., Ltd., were held on April 26th, when a dividend of 15 per cent. was declared on the preference "B" and ordinary shares of the companies, as for 1927. There were present at the meetings Mr. James Thompson, Mr. A. E. Thompson, and Major S. J. Thompson, D.S.O., governing directors, and about 450 employé shareholders. The chairman said that it had been decided to put down a works in Australia to develop the companies' manufactures.

Associated Gas and Electric Co.

Last week this company published (for information only), in compliance with Stock Exchange regulations, a statement of its capitalisation, objects, &c. This showed that the share capital issued was in no-par-value stock of various classes, the total consideration received being $80,480,846. On October 31st the principal amount of funded debt outstanding was $45,760,500. The company was incorporated under the laws of New York State in 1906. It is a holding company for the securities of other corporations and has powers to assist, financially or otherwise, the corporations in which it is interested. The operating companies within the Associated Gas and Electric System own 290,500 kW of electric generating plant (46,128 kW hydro-electric), 3,124 miles of h.p. transmission lines, and large gas undertakings.

Urban Electric Supply Co., Ltd.

The net profit for the year ended December 31st, 1928, after providing for interest, income tax, &c., is £100,832, as compared with £98,749 in 1927. To this is added £22,219 brought forward, making £123,051. Deducting the interim dividends and a small sum devoted to the purchase of funded dividend certificates, there remains £99,993. From this £30,000 is put to depreciation reserve, £15,000 to general reserve, £1,740 to writing off expenses of increased capital, and £2,000 to the staff benevolent fund. The final ordinary dividend is 4 per cent., making 7 per cent. for the year (as for 1927), and £22,953 is carried forward.

Craigpark Electric Cable Co., Ltd.

The directors report a profit of £17,703 for the year ended March 30th last (against £15,594 in 1927-28), and to this is added £1,222 brought forward, making £18,925. The allocations include £9,000 to reserve (against £7,607), and the ordinary dividend is 5 per cent., as compared with 4 per cent. for 1927-28, and 7½ per cent. for 1926-27; a balance of £2,200 is carried forward, subject to directors' fees. There was a considerable increase in the factory's output during the year and the business generally continues to expand. Mr. D. A. Matheson is recommended for appointment to the board. Meeting: To-day (Friday).

Johnson & Phillips, Ltd.

After providing for bad debts and charging about £15,000 to revenue for maintenance of plant, buildings, &c., the profit for the year ended December 31st, 1928, was £106,417 as compared with £108,858 for 1927. A net balance of £85,072 is added, making available £191,489. From this debenture interest, &c., is met and it is proposed to pay a final dividend of 5 per cent., again making 10 per cent. for the year, leaving £80,903 to be carried forward. The annual meeting was to be held yesterday (Thursday).

Marconi's Wireless Telegraph Co., Ltd.

The directors have decided to pay an interim dividend of 20 per cent. on the ordinary shares and an additional 10 per cent. on the 7 per cent. cumulative participating preference shares. They state that after the payment of these dividends the available profits will not permit of any further distribution in respect of the year 1928. Meetings of the cable companies and the Marconi Company are to be held on May 29th to consider certain alterations in the articles of association in connection with the merger scheme. At the Marconi Company's meeting the directors will submit the 1927 accounts for approval.

Richmond (Surrey) Electric Light and Power Co., Ltd.

Presiding at the annual meeting on May 3rd, Sir Thomas Bethell, in the absence of Sir Harry Renwick, read the chairman's speech. The chairman said that the company was changing over from d.c. to a.c. Since the close of the year 591 kW of new business had been obtained, and the output of electricity had increased by 20 per cent. over the corresponding period of last year, while the number of consumers had increased accordingly. The report and accounts were adopted.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved :—

Bastian Electric Co., Ltd.
Carey Transmission, Ltd.
East Lancashire Electrical Co. (Accrington), Ltd.
Radio Photographic, Ltd.
Wireless Association of Great Britain, Ltd.

Cawnpore Electric Supply Corporation, Ltd.

The accounts for 1928 show that the surplus on the year's working was £86,861, as compared with £67,637 in 1927. After deducting debenture interest and adding £3,150 brought forward, the amount available is £78,214. From this £27,500 is transferred to depreciation and renewals account, £4,002 is written off issue expenses, and income tax and sinking fund instalments are paid. A final ordinary dividend of 7 per cent. is recommended, again making 10 per cent., and £3,824 is to be carried forward. The sales of energy rose from 24,741,660 to 26,804,762 kWh. Meeting : May 14th.

Provincial Electric Tramways Co., Ltd.

The balance on the 1928 revenue account is £16,749, against £15,233 in 1927. There is added £3,139 brought forward, making £19,888. After providing for debenture interest, &c., and transferring £5,000 to reserve, the directors propose to pay a year's dividend on the preference shares, leaving two years' arrears, and to carry forward £3,679. The Portsmouth Street Tramways Co. is seeking Parliamentary sanction to the abandonment of tramways between Gosport and Fareham and to substitute omnibuses.

Weston-super-Mare and District Electric Supply Co., Ltd.

The net revenue for the past year rose from £39,755 to £42,635, and the addition of £4,959 brought forward makes £47,644. After meeting expenses, debenture interest, &c., £17,800 (against £7,000) is transferred to reserve. The ordinary dividend is maintained at 10 per cent., and £6,149 is carried forward. During the year 50,000 £1 ordinary shares were issued, raising the capital to £150,000.

Anglo-American Telegraph Co., Ltd.

The rent received from the Western Union Telegraph Co. in respect of 1928 was £262,500; to this is added £65,625 brought forward, making £328,125. Four dividends totalling £3 15s. per cent. have been paid on the ordinary stock, and one of £1 10s. per cent. on the deferred stock. The balance carried forward remains at £65,625. Major R. L. Benson, D.S.O., has been appointed to the vacancy on the board caused by the death of Mr. R. H. Benson.

Anchor Cable Co., Ltd.

The profit for the year ended December 31st, 1928, amounted to £84,974 (against £64,748). After meeting debenture interest (£2,250) and adding £113,836 brought forward, there is an available balance of £196,560. The reserve for income tax receives £10,000 (against £15,000) and it is proposed to pay a final dividend of 15 per cent., making 20 per cent. for the year as compared with 15 per cent. for 1927 and 10 per cent. for 1926. The report records the recent death of Mr. E. G. Buxton, who joined the board in August, 1927.

Greenwich Cable Works, Ltd.

The net profit for the past year amounted to £3,008. The dividend in respect of the year 1926 is paid on the 7 per cent. first preference shares and £3,976 is carried forward. The bulk of the machinery has been transferred to the new works and the name of the company has been changed to "Croydon Cable Works, Ltd." Since the close of the year a further year's dividend has been paid on the 7 per cent. first preference shares.

Penarth Electric Lighting Co., Ltd.

The net revenue for 1928 amounted to £11,341, as compared with £12,217 in 1927, and after deducting administration and general expenses, income tax, debenture and other interest, and providing £2,000 for renewals, there was a net surplus of £4,027 (£4,942) to which was added £3,200 brought forward, making £7,247. A dividend of 7½ per cent. for the year, and the placing of £2,000 to reserve are proposed, leaving £3,022 to be carried forward.

Merthyr Electric Traction and Lighting Co., Ltd.

There was a reduction in the revenue for the past year from £25,896 to £23,868; with the balance of £3,706 brought forward the available balance is £27,574. Debenture interest is paid and £7,000 is allocated to renewals. A dividend of 2½ per cent. is again to be paid on the ordinary shares, and £3,653 remains to be carried forward.

West Gloucestershire Power Co., Ltd.

The report for the year ended December 31st, 1928, records an increase in the revenue from £50,339 to £60,322; after meeting expenses, debenture interest and other charges, there was an adverse balance of £1,631 which is deducted from the amount brought forward, leaving £40,640 to go to the next account.

American Telephone and Telegraph Co.

The largest bond issue of recent years was made on April 30th by the directors of this company who offered stockholders the right to purchase approximately $219,000,000 in convertible 4½ per cent. bonds in the ratio of $100 at par value for each six shares of stock held.—*Reuter* (New York).

Rushden and District Electric Supply Co., Ltd.

The directors are offering the shareholders 10,000 £1 shares at the price of 24s. each in proportion to their present holdings. The allotment letter includes a renunciation form for the use of shareholders who do not desire to take up the new shares. The list is to close on May 21st.

Birkdale District Electric Supply Co., Ltd.

The balance of the net revenue account for 1928, after providing for income tax, &c., and adding £6,232 brought forward, is £12,204. A sum of £3,500 is transferred to reserve, and after paying a dividend on the ordinary shares of 6 per cent. £5,944 is carried forward.

Associated Electrical Industries, Ltd.

Mr. H. C. Levis (chairman) presided at the annual meeting on Tuesday last and in the course of his address said that this year had so far shown increased business (mainly for smaller apparatus) although prices still tended to be on a lower basis. A report of the meeting will appear in our next issue.

Richardsons, Westgarth & Co., Ltd.

The accounts for the year ended October 31st last show a profit of £30,089 (against £28,253). The ordinary dividend is reduced from 5 to 2½ per cent.

Cable, Telephone and General Trust, Ltd.

The directors report a net revenue of £26,202 for the past year, and recommend a dividend of 4 per cent. on the ordinary shares.

Coventry Chain Co., Ltd.

An interim ordinary dividend of 3 per cent. has been declared, as last year.

Tyneside Electrical Development Co., Ltd.

The title of this company has been altered to "The Tyneside Investment Trust, Ltd."

Dubilier Condenser Co. (1925), Ltd.

The half-yearly dividend has been declared on the 7½ per cent. cumulative preference shares.

Glenfield & Kennedy, Ltd.

The ordinary dividend is maintained at 10 per cent. for the last year by a final distribution of 6 per cent.

Chloride Electrical Storage Co., Ltd.

A final dividend of 5 per cent., and a bonus of 15 per cent., both free of tax, are to be paid on the ordinary shares. The total distribution for the year is thus again 25 per cent. tax free.

British Power and Light Co., Ltd.

According to the financial Press, a company bearing this title has been formed with a capital of £1,600,000 for the purpose of holding securities of electricity distribution undertakings.

Dutch Company.

Philips Glowlampworks.—This week the company was to make an issue of about £1,160,000 in ordinary shares at 250 per cent. and £440,000 in 6 per cent. preference shares at 130 per cent. Shareholders were to receive prior rights while an additional £200,000 of ordinary shares was reserved for subscription on the same terms by the General Electric Co. of America, which already has a large holding in the company. The proceeds of the issue are to be used primarily for the extension of the company's factories.

The report for 1928 states that the works were operated at full capacity and the turnover substantially increased. The works and plant were considerably extended and plans are in hand for further extensions both in Holland and abroad. The trials of the company's short-wave transmitter proved very successful. At Eindhoven 20,000 persons are now employed; a further 5,000 are engaged in undertakings controlled by the company in Holland and a still further 10,000 are employed abroad, making a total of 35,000. The future is looked forward to with confidence as a result of the increase in the use of electric light and in the sale of radio apparatus. After providing for depreciation the accounts show net profits of 18,710,000 fl. as compared with 11,559,000 fl. in the previous year, and the dividend on the ordinary shares remains at 21 per cent.

German Companies.

The *Felten and Guilleaume Co.* of Cologne-Mulheim, intends to pay a dividend of 7½ per cent. for 1928, as compared with 6 per cent. in the previous year.

The *Dr. Paul Meyer Co.*, Berlin, which belongs to the A.E.G. group, reports net profits of 361,000 marks for 1928, as against 345,000 marks in the previous year. The dividend is 8 per cent., as in 1927.

Swedish Company.

The report for 1928 of the *A.B. L.M. Ericsson* states that the value of the deliveries from the telephone works amounted to 25.90 million kr. and from the cable works to 5.24 millions, the corresponding figures for 1927 being 20.37 millions and 4.11 millions, respectively. The foreign subsidiary works and sales companies were able to increase their turnover, and the foreign concession undertakings co-operating with the company showed progress and produced improved results. The reconstruction of the Southern Italian telephone system was practically completed, and the new automatic network in Naples and Messines was inaugurated at the end of October. During the year investments were made in works in Norway, Estonia and Czecho-Slovakia, as well as in Polish and South American concession undertakings. The accounts show that the net profits increased from 2,490,000 kr. in 1927 to 3,770,000 kr. last year, and the dividend is raised from 6 to 7 per cent.

Spanish Company.

The accounts of the *Compania Hispano-Americana de Electricidad*, Madrid, show net profits of 50.88 million pesetas for 1928, as compared with 43.20 millions in the previous year. It is proposed to pay a supplementary dividend of 9 per cent. in gold on the A to D shares and 4½ per cent. in gold on the E shares, so that including the interim rate of 6 per cent. paid in December, a total rate of 15 per cent. net will be distributed.

French Company.

The *Compagnie Générale d'Electricité*, Paris, reports net profits of 20.99 million fr. for 1928, as compared with 25.33 millions in the 18 months forming the previous financial year. It is intended to pay a dividend of 17 per cent., against 14 per cent.

Stocks and Shares.

MONDAY EVENING.

THE Stock Exchange has entered upon the three weeks' settlement which embraces the Whitsun holidays, and concludes, by coincidence, on the day of the General Election. Therefore holidays and politics have joined forces to lay a further check upon business in stocks and shares—business that has now fallen away to a low ebb pending a settlement, more particularly, of the coming contest between the parties. It is difficult to discover any market in the Stock Exchange where animation prevails, but the American buying of shares in electrical manufacturing companies is certainly one of the features of the day. The books of the Eastern Telegraph, Eastern Extension and Western Telegraph Companies, together with those of the Marconi Company, are closed for three weeks. This places no impediment in the way of dealing with the stocks and shares. In practice, however, the result is that interest has become less than of late. No little curiosity is felt as to the time within which the Bank of England will receive the 60 per cent. assent to the merger proposals needful to render the latter operative.

The Hand of New York.

Associated Electrical Industries ordinary shares are a particularly lively market on American dealing. The fluctuations are governed almost entirely by orders from the other side. The price has been up to 57s.—this happened on a Saturday morning when the London Stock Exchange was closed—and down to 49s. At the time of writing, on Monday evening in this week, the quotation is 52s. 6d. Visitors lately landed from New York speak of the buying movement as being largely a matter of speculation. The company has declared a dividend of 6 per cent., so that, from the yield point of view, for the price to stand at anything like 50s. is clear evidence of motives for buying that take no account of immediate return on money invested. The profit for the past year, given in last week's ELECTRICAL REVIEW, is £258,772, about £4,000 more than that of the preceding twelvemonth. Nothing is included in this total from the company's new interests.

American Influences.

In view of the manner in which American demand has clamoured for General Electrics, Associated Electricals, and, earlier, for some of the electricity supply companies' shares, an impression is current that the desire exists on the part of American interests to obtain a firm foothold in the industry, through the acquisition of shares in British companies. No doubt can be felt as to the feelers put forth from American quarters in regard to the possibility of obtaining a substantial measure of control over companies whose shares fall within this particular area. It might be misleading, and perhaps cause loss, if mention were made here of the companies around which rumour is weaving its web of possibilities. But holders of shares in good-class electrical manufacturing and supply concerns are naturally paying marked attention to the position. Rumours come from various parts of the country as to what undertakings are likely to be the subject of American attention. The atmosphere is charged with what may be called a mild tension of excitement, very different from the placid air in which these companies' shares are accustomed to move.

Cable and Wireless.

Reference has been made above to the closing of transfer books in the Eastern Cable group and the wireless companies included in the merger. This closure has had the effect of checking business, but the tendency is hard as regards the cable stocks, while Marconi maintain their level at 85s. with firmness. Were it not for the disputes that encircle the Marconi Company's shares, it is not unlikely that the price of Marconis would be standing higher than it does to-day. With regard to the cable stocks, the expectation is that about £300 for Eastern ordinary, and, say, £30 for the shares of the two other companies, will represent the levels to which the prices may be expected to attain when the merger is complete. The Bank of England will send out notices on May 17th, asking whether proprietors desire to assent or not to the proposals. After the transfer books reopen, we understand that the Bank of England will renew, to new proprietors then to be registered, the chance of assenting to the scheme. Canadian Marconis have risen to £2; Burndept Wireless are a little better at 5s. The chairman of the Columbia Graphophone Company is credited with the statement that fusion of this company with the Radio Corporation of America would seem both logical and practical.

Home Electricity Supply.

In the list of home electricity supply companies St. James' and Pall Mall are 1s. better at 27s. 6d., while County of London slipped back a similar amount to 54s., the latter on a little profit-taking. A demand has sprung up for Shropshire, Worcestershire and Staffordshire shares, with the result that prices are better at 46s. 3d. for the "A" ordinary, and 44s. for the "B" ordinary. The suggestion was made that the Americans were buying. Whether this is so or not, the advance in price is sufficiently explained by the speech by Mr. Garcke, the chairman, at the recent meeting. A resolution was passed creating 350,000 new 6 per cent. cumulative preference shares of £1 each. The price of the existing preference is 22s. 6d. Dividends are payable in March and September. Midland Counties rose a florin to 30s., the advance being linked to that in Shropshire shares. Bournemouth and Poole at 65s. 9d. are 1/16 higher, responding rather tardily to the statements made at the recent meeting. Lancashire Electric new ordinary are 6d. premium, and the new Clyde Valley 11s. 6d. premium.

Home and Foreign Traction.

British Electric Traction deferred ordinary stock has regained the loss of a few weeks ago, and is 50 points up at 900. Brazilian Tractions at 58½ have shed a point, but the market

for dollar stocks as a whole is not bad. It is said by those who should be in a position to know, that the monetary situation in New York and Montreal is gradually clearing. Montreal seems to have been even more afflicted with financial indigestion than New York was, and time will probably be yet required before matters are fully straightened out in that centre. Consolidated Gas of Baltimore 4½ per cent. gold bonds are 4 up, at 100. The Mexican group is inclined to sag, there being small falls in the bonds of the Mexico Tramways and the Mexican Light and Power Companies. Power Corporation of Canada shares at 110 are 3 points higher. Of the London undertakings, London United Tramway 4 per cent. debenture stock is nominally a point higher at 62, but stock changed hands the other day up to 65. The preference shares are quoted at 8s. 6d. and the ordinary at about 1s. 6d. Metropolitan Electric Tramways ordinary were last done a couple of months ago at 5s. 6d.; the 5 per cent. preference changed hands the other day at half-a-guinea. London and Suburban Traction ordinary are 4s. 6d., and the preference hold their advance to 12s. 6d.

Undergrounds.

In the Home Railway market Metropolitan consolidated has fallen a point to 59½, and Districts weakened to 75½, Home Railway stocks as a whole being dull. Underground Electric income bonds, however, rallied to 113. The ordinary shares are regarded as a good lock-up investment of speculative order paying, as they do at the present time, £5 13s. 10d. per cent. on the money, though some people contend that District ordinary stock, yielding 6⅝ per cent. on the money, is the cheaper purchase.

Indian Shares.

The Calcutta Electric Supply Corporation is about to increase the capital to four million pounds by the creation of an issue of one million additional shares of £1 each. The price of the existing shares is 53s. 9d., and the company's 5 per cent. cumulative preference stand at 22s. 3d., the dividends on the latter being paid free of income tax. The Cawnpore Electricity Supply Corporation is paying 10 per cent. for the year, the report showing very good figures. The dividend is at the same rate as in the previous twelve months; the price of the ordinary shares is quoted at 33s. 9d., and that of the 7 per cent. preference at 22s. 6d. Madras Electric Tramways gross profit for 1928 of £29,000 is nearly double that of the previous year. The company's 6 per cent. preference shares stand at 13s. The large increase in traffic receipts and in revenue are attributed to lower fares and the introduction of season tickets.

Manufacturing Companies' Shares.

General Electrics have reacted to 3, and the 6½ per cent. preference at 23s. 6d. are 6d. lower. The market is no longer the scene, as it was a month ago, of violent excitement and price variations. Johnson & Phillips at 36s. 3d. show no change on the issue of the report, which gives the 1928 profits at £106,416, or about £2,400 under those for 1927. In their ex rights guise, British Insulated at 3⅜ have attracted a little buying. Brush shares are firm on a satisfactory report. The new issue of Imperial Chemicals ordinary shares at 33s. 6d. commanded a premium of 1s. 6d. when dealings began in them three weeks ago, but the premium ran right off. This Monday was the latest time for making application for the new shares. A further advance of 1s. 9d. carried British Aluminium to 51s. 3d., making a rise of 4s. within a fortnight. Philips Glow Lamp shares, in which Amsterdam has a free market, have been favourably affected by a good report. The shareholders are offered new capital on bonus terms.

Telephone and Telegraph.

The Oriental Telephone & Electric Company repeats its previously-paid final dividend of 8 per cent., free of tax, and the price of the shares is unchanged at 2⅜. American Telephone and Telegraph stock has eased off to 238, and International Telephone to 260, declines of 2 and 5 points, respectively. Business was marked last week in Constantinople Telephone ordinary at 61s. 3d.; this is ex the recently-paid dividend of 3s. 6d. Bogota Telephones are 9d. higher at 29s. 3d. A fair amount of investment business in Anglo-American Telegraph 6 per cent. preferred ordinary has left the price at 102½. Atlas Light & Power ordinary at 25s. 6d. are somewhat heavy on sales by speculators disappointed at the failure of the expectations that American buying would put the price much higher before the beginning of the current month.

Miscellaneous.

Shares affected by the prices of tin and of rubber have been depressed as a consequence of the weakness in both materials. The engineering, iron and steel group displays a dull disposition, public interest in the shares being very tepid. Babcock & Wilcox at 3½ have shed 1/16. The common answer given in reply to inquiries as to why the price of any shares is heavy at the present time, refers to the General Election as the main cause.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 6 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	65/9	+1/16	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¼	8¼	26/-	—	5 7 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	32/6	—	... ...
County of London	1	7½	10	54/-	—1/-	3 14 1
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	28/-	+6d.	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	9	2¹⁷/₂₀	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	30/-	+2/-	4 6 8
Mid. Elec. Power	1	15	8	35/9	—	4 9 6
Newcastle on-Tyne Ordinary ...	1	6	6	1¾	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref. ...	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6xd	+1/-	5 1 10
Scottish Power	1	8	8	30/6	—6d.	5 0 9
South London	1	8½	8½	26/6xd	—	5 5 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	59½	—1	5 17 8
do. District	,,	4	5	75½	—½	6 12 5
Underground Electric	£1	5	7	23/6	—	5 13 10
do. do. Income ...	Bonds	6	6	113	+1	5 6 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2½	—	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	280	—	*3 11 5
Globe Tel. and T. Ord.	10	10	10	28½	—	*3 11 0
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	54½	—1	*4 11 9
Marconi	10/-	10	—	4¾	—	... ...
Marconi-Marine	1	12½	15	9¾	—	4 12 4
Oriental Telephone Ord.	1	12	12	2⅜	—	... ...
Western Telegraph	10	10	10	27½	—	3 12 9

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3½	—	7 18 0
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	5	—	900	+50	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	58½	—1	3 8 5
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/6	—	... ...
London United Tram Deb. ...	Stock	4	4	62	+1	6 9 1
Mexico Trams, 5% Bonds ...	—	5	5	71⅜	—	6 19 10
Mexican Light Common	100	Nil	Nil	77½	—	... ...
do. 7% Pref.	100	7	7	75½xd	—	9 5 6
do. 1st Bonds	—	5	5	76½	—1	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/6	—1/16	2 5 9
Babcock & Wilcox	1	13	15	3½	—1/16	*4 12 4
British Aluminium Ord.	1	10	10	2¹⁵/₁₆	+1/8	*3 18 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	3⅜xr	—	4 8 9
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4¼	—	4 13 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	8/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—6d.	5 10 8
do. Ord.	1	7½	10	3	—⅛	3 6 8
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 4
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	24½	—	*4 19 3

* Dividends paid free of Income Tax.

The Training of Apprentices for Electrical Contracting Work.

The outcome of a scheme of certification in electrical installation work which has the approval of the Electrical Contractors' Association.

By H. R. T.

TWO pamphlets* which were recently published by the City and Guilds of London Institute, Department of Technology, with the approval of the Electrical Contractors' Association (Inc.), are the outcome of the deliberations of an Advisory Committee jointly formed in 1928 by the Institute and the E.C.A. to consider a scheme of certification in electrical installation work; and it has now been adopted by the Institute for the purposes of its examinations and by the Association in connection with its apprenticeship scheme.

Course A, for junior electricians, is designed to cover the two critical years between the time a boy leaves the elementary school and the time he is old enough to be bound an apprentice, and serves to prepare him for the more specialised courses described in the other pamphlet. Its objects are to develop in him observation, initiative, accuracy, and facility of expression, and to familiarise him with the materials and tools used in installation work. Its syllabus is admirably adapted to achieve those objects.

The first year's course is of a general nature, and in the workshop is mainly concerned with the properties of the commoner metals and building materials, and with the more familiar phenomena of liquids and of heat. In the second year the course becomes more definitely electrical, and introduces the student to the elementary laws which govern a simple circuit. Six pages of the pamphlet are devoted to the guidance of teachers, with suggestions for short talks, demonstrations, and easy experiments. Particular stress is laid on the practical nature of the course; and it is certainly well calculated to accustom the student to active doing and constructing, and to develop his ingenuity and his powers of observation. It is insisted that "very little theory is required by the student at this stage; the knowledge which he requires is that of a *user* and not of a designer." This phrase—"the knowledge of a user"—is the keynote not only of this course, but also of the courses B and C intended to follow it. In short, the primary aim of the elementary course is to accustom the boy to handle various materials and the tools with which they are worked, and to teach him their properties, classification and nomenclature by practical demonstration and the use of trade catalogues, rather than by theory and text books.

Workshop practice, however, is only half the course. The other half is intended to be given over to drawing and calculations. "Particular attention should be paid to developing the students' power of description" and, "wherever possible, the 'engineer's language,' *i.e.*, drawing, should be used as an adjunct to verbal description." It is notorious that the average product of the elementary school cannot express himself clearly; too often he cannot write legibly, logically, or even grammatically. He may be intelligent—he generally is—and he may have knowledge—he sometimes has—but he has never been trained to put his ideas and his knowledge on to paper or, for that matter, into words. If the present course succeeds in its aim of transposing those inarticulate lads into young men who can, with clear words and accurate sketches, tell the world what they know, it will have achieved something very much more than the mere manual training of a mechanic which satisfied an earlier generation of technologists.

That this has been the chief objective of the designers of the course is evident. "Training in the power of expression is the main function of the course throughout the two years"; and the workshop practice is intended as a basis for oral and verbal description at least as much as it is designed to familiarise the boy with the facts described.

The syllabus in drawing and calculations is well designed to introduce the boys to the discipline of figures and dimensioned sketches, a discipline neglected in the schools and essential to the clear thinking which must precede clear expression. If the syllabus has a fault it is that, on the "calculations" side, it is somewhat too ambitious; indeed, on a comparison it appears to be in some respects more advanced than the corresponding section of the first two years of the later B course, which was surely not intended. It is doubtful whether it is worth while confusing boys with the metric measure, which, as things are to-day, they may never have to use in practice. In "drawing," too, it is superfluous, from the practical point of view, to ask them to shade and colour their sketches, a thing which no foreman is ever expected to do.

Course B is intended for those who have obtained the needful grounding of course A or its equivalent, and, at the age of 16 or more, are aiming at an "electrician's certificate." It is designed to cover three years of two evenings a week. At the end of that time an examination in theory is set by the City and Guilds of London Institute, and an "Interim Certificate" is awarded on the basis of the result and of the practical work done by the student in the past year. An apprentice employed by an electrical contractor, or a candidate otherwise engaged in electrical installation work, having obtained the "Interim Certificate," may be awarded the "Electrician's Certificate" on the recommendation of an advisory committee guided by a statement of his practical training and work, given on a special form.

The syllabus of course B is, with refreshing novelty, based upon the "Regulations for the Electrical Equipment of Buildings" of the I.E.E., which in effect becomes the official text-book of the course. "The basic idea underlying this is that electrical installation men, if they are to carry out their work properly, must know what the Regulations are, what they mean, and why they have been considered necessary." Moreover, throughout the course, standard wiring tables and the like are used, and the students are taught by the use of catalogues the commercial forms and names of the materials and apparatus they have to handle in their work. This is admirable commonsense. Not only are they acquiring the theory and practice of a normal course of elementary electricity and magnetism, but they are acquiring an essential familiarity with the rules which govern its commercial application to the work for which they are being trained. Again, by the use of catalogues, they are acquiring a knowledge of current materials, fittings, and accessories which will help them later to compare and select those most appropriate to a specific job; and an inkling of their costs which—it is to be hoped—will influence them to avoid waste and extravagance.

By taking the successive clauses of the "Regulations" as text, all the technical equipment of an electrician is thoroughly covered; *e.g.*, regs. 42A (*a*), 6, 86, 87, 70-74 serve as a peg on which to hang the laws governing two-wire supply systems: and regs. 56-58 cover the subject of the functions of a dynamo. Some of the clauses, indeed, might with advantage be passed over. The average wireman has little occasion for knowledge of internal-combustion engines, dynamos, or secondary batteries, and their discussion might well be deferred to the more advanced course, C.

Course C is intended for those who desire to qualify for higher positions, such as that of foreman, and is designed to cover two years of three evenings a week. It leads, by a similar procedure to that in course B, to an "Electrician's *Extra* Certificate." The syllabus covers more advanced electrical and magnetic theory and practice, and the principles of d.c. and a.c. plant. In this syllabus, too, is the only mention of the "general principles of illumination"—which is a pity; for an elementary knowledge of optics would be as useful in course A as the subject of "liquids," and in course B it should be taken as essential, since the modern electrician is expected to be familiar with ever new developments of lighting. In a course intended for foremen, too, something should be expounded of the technicalities of overhead lines; and room should be found for some discussion of the various specialised installations which sooner or later he will be called upon to supervise: theatre work, for example. Another, and from one point of view, the most serious omission from an excellent syllabus, is any mention of what may be called the clerical side of a foreman's job: the writing of reports, the requisitioning and handling of his stores, and the all-important accurate keeping of his day-sheets. No foreman, however knowledgeable and skilful in his trade, will keep his job long who cannot satisfy his head office in these particulars.

* "Electrical Installation Work," Course A, for junior electricians, for boys of 14 to 16 years of age (12 pp. 8vo). "Examinations in Electrical Installation Work," Courses B and C, syllabuses and regulations (16 pp. 8vo).

The Electrical Imports of Egypt.

Figures for 1927 and 1928 Compared.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1928 is taken from the recently-issued trade statistics. The figures for 1927 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1927. £E	1928. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	212,000	152,000	– 60,000
From Great Britain ...	62,000	32,000	– 30,000
,, United States ...	14,000	15,000	+ 1,000
,, France	44,000	43,000	– 1,000
,, Italy	18,000	20,000	+ 2,000
,, Switzerland ...	21,000	14,000	– 7,000
,, Germany	24,000	18,000	– 6,000
Internal combustion engines, stationary—			
Total	278,000	452,000	+174,000
From Great Britain ...	141,000	285,000	+144,000
,, France	1,000	3,400	+ 2,400
,, Italy	4,000	9,400	+ 5,400
,, Switzerland ...	48,000	70,000	+ 22,000
,, Germany	52,000	68,000	+ 16,000
Electric lamps—			
Total	44,000	46,000	+ 2,000
From Great Britain ...	3,000	1,400	– 1,600
,, Germany	8,000	7,400	– 600
,, France	600	1,100	+ 500
,, Holland	16,000	18,700	+ 2,700
,, Czecho - Slovakia	400	500	+ 100
,, Austria	8,500	10,400	+ 1,900
Carbon rods for arc lamps—			
Total	500	520	+ 20
Electric cars and wagons—			
Total	26,000	5,000	– 21,000
Telegraph and telephone apparatus, ordinary—			
Total	20,700	8,500	– 12,200
From United Kingdom	6,000	5,200	– 800
,, Sweden	10,000	2,500	– 7,500
Radio apparatus—			
Total	3,000	6,000	+ 3,000
From France	700	900	+ 200
Radio and wireless parts and fittings—			
Total	17,800	17,700	– 100
Telephone and telegraph parts and fittings—			
Total	49,500	19,000	– 30,500
From United Kingdom	31,800	11,600	– 20,200
,, Sweden	13,000	6,000	– 7,000
Batteries, accumulators and parts—			
Total	34,000	35,000	+ 1,000
From United Kingdom	17,700	14,800	– 2,900
,, Germany	4,500	5,600	+ 1,100
Meters, electric, gas and water—			
Total	16,000	23,000	+ 7,000
From Great Britain ...	600	1,000	+ 400
,, France	7,700	13,000	+ 5,300
,, Germany ...	5,300	5,600	+ 300
Electric and gas pendants—			
Total	58,000	56,000	– 2,000
From Great Britain ...	3,000	3,200	+ 200
,, France	33,000	29,000	– 4,000
,, Germany ...	10,000	9,800	– 200
,, Italy	7,000	7,700	+ 700
Electro-medical apparatus—			
Total	11,600	13,900	+ 2,300
From Germany ...	3,700	5,400	+ 1,700
,, Great Britain ...	4,800	2,100	– 2,700
Electric light fittings—			
Total	59,000	77,000	+ 18,000
From Great Britain ...	6,600	10,600	+ 4,000
,, Belgium	6,300	6,800	+ 500
,, France	12,000	14,700	+ 2,700
,, Germany	18,000	22,000	+ 4,000
,, Italy	3,000	11,600	+ 8,600
,, Switzerland ...	4,600	3,700	– 900
,, United States ...	4,000	5,000	+ 1,000
Other electrical appliances and batteries—			
Total	26,000	32,000	+ 6,000
From Great Britain ...	3,000	3,800	+ 800
,, France	4,000	4,300	+ 300
,, Germany ...	7,000	7,400	+ 400
,, Italy	6,000	7,200	+ 1,200
,, United States ...	4,000	7,800	+ 3,800
Electric cables, insulated—			
Total	32,000	35,600	+ 3,600
From Great Britain ...	1,700	3,700	+ 2,000
,, Belgium	8,600	8,100	– 500
,, France	8,400	8,600	+ 200
,, Germany ...	11,000	12,700	+ 1,700
,, Italy	1,700	1,500	– 200
Uninsulated electric copper wire—			
Total	22,000	23,300	+ 1,300
From Great Britain ...	3,300	6,500	+ 3,200
,, France	18,000	12,500	– 5,500
,, Germany	200	1,300	+ 1,100
Electric wire and cable, armoured—			
Total	70,000	146,000	+ 76,000
From United Kingdom	24,000	103,000	+ 79,000
,, Belgium	2,700	5,500	+ 2,800
,, France	28,000	24,000	– 4,000
,, Germany	12,000	11,000	– 1,000
,, Italy	3,000	1,200	– 1,800

£E=£1 0s. 6¼d.

The Federation of British Industries.

Lord Ebbisham's Address.

THE annual general meeting of the Federation of British Industries was held on May 1st when Lord Ebbisham, the retiring president, delivered his address. In the course of this Lord Ebbisham said that although the past year had been disappointing in many ways there were no grounds for pessimism as to our industrial future. The export trade figures were encouraging even if the rate of improvement had been relatively slow. British manufacturers had not lost their ability to adjust themselves to new conditions and the handicap of depreciated foreign currency was disappearing. Since the beginning of the war new industrial countries, protected by high tariff walls, had arisen; the centre of gravity of foreign trade had tended to move away from Europe to the countries bordering on the Pacific; and there had probably been important changes in the relative importance attached by the peoples of the world to the different classes of goods and services entering into foreign trade. Our "invisible" exports had expanded in a marked manner. We should be careful not to slavishly follow American or German practice, for we might find in the long run that such practice was unsuited to British conditions. British energies should be directed to the discovery of the quickest way of exploiting our acknowledged preeminence as the producers of high-quality goods and that seemed to depend as much on a revival of our traditional spirit of initiative and adventurous enterprise as on learning the methods of organisation of other countries. Referring to the negotiations with the General Council of the Trades Union Congress, Lord Ebbisham said that the Federation believed that valuable results could be obtained by co-operation; by a mutual exchange of ideas both sides would come to appreciate each other's difficulties and make a united contribution to an increase of national prosperity and employment. The Federation had assisted in the work of the League of Nations and the International Chamber of Commerce, and it had continued its policy of maintaining contact with the national industrial federations in other countries. He had just returned with an F.B.I. delegation from Sweden, where they had discussed important matters with the Federation of Swedish Industries, including the abolition of double taxation and the possibilities of improving the coal trade between the two countries. Lord Ebbisham said that the Federation had expressed its regret at the conclusion of the South African-German commercial treaty, and had also made representations to the Canadian Government in connection with the stipulation that goods must be 50 per cent. British as to raw material and/or labour in order to qualify for preferential tariff treatment. The Spanish Government had agreed to meet a delegation from the Federation to hear its views upon the Spanish Customs tariff. Among other matters to which the president referred were the concession obtained in respect of companies' super tax, claims for obsolescence allowances, stamp duties on amalgamations, and penny postage. He expressed his belief that the Government's rating relief scheme would prove of definite value to the heavy industries and agriculture and to many other industries indirectly. The Federation had continued to aid in the promotion of efficiency in industry, especially in the direction of practical standardisation. Their existing premises had become too small and they had completed arrangements for the erection of some fine premises in Tothill Street, Westminster, which they hoped would be ready for occupation by the end of next year.

The membership remained at a satisfactory figure and during the last few months many new members had been elected.

Variable-speed A.C. Commutator Motors.

Notes and Comments on Some of the More Recent Types of Machine.

By C. V. HILL.

(Extracts from a Paper read before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.)

(Concluded from p. 783.)

A.C. Commutator Motors for Power Factor Correction.—It is intended to deal briefly with a motor of very similar construction to the a.c. variable-speed motor, and in which similar principles are involved, but which is designed to give power factor correction instead of speed variation. This machine is known as the " No Lag " motor. To obtain a motor capable of some desired power factor improvement, it is not necessary to have the commutator voltage variable. It can be made constant. This is done by connecting one end only of each phase of the secondary winding to the brushes, the other ends being joined together to form a neutral point. This results in a considerable simplification of the brushgear, only one set of brushes being required, and these can be mounted on a similar type of yoke to that used for direct current machines, since they have only to be capable of a small movement sufficient to allow for small adjustments in the phase of the regulating voltage, to enable the power factor to be set to the desired figure.

Further simplifications can be effected by suitably designing the regulating and secondary windings, whereby it is possible to reduce the number of brushes required, with a considerable gain in simplicity and cheapness. Since the motor runs near its synchronous speed, the commutator is not required to handle any appreciable power, and has simply to carry the wattless kVA used to produce power factor improvement. It can, therefore, be made very small, since the compensating voltage is only 2 or 3 per cent. of the standstill voltage of the secondary.

The arrangement of the windings is shown in diagram, fig. 7. The regulating winding is now referred to as the " compensating " winding, as it is responsible for the power factor correction.

It will be noted that the correction takes place on the secondary side of the motor, and hence an important saving in the kVA required from the compensating winding to produce a desired effect in the primary can be made. A wattless component of one kVA due to the compensating winding will produce an effect in the primary as though a primary leading kVA of full frequency/slip frequency were added to the primary circuit. This principle enables a small regulating winding and commutator to produce large changes in the total power factor of the motor.

In this motor the " compensating " winding is wound in the bottom of the rotor slots, and the primary winding above it. On large machines the compensating winding is placed in the top of the slots, as in the case of the variable-speed machine.

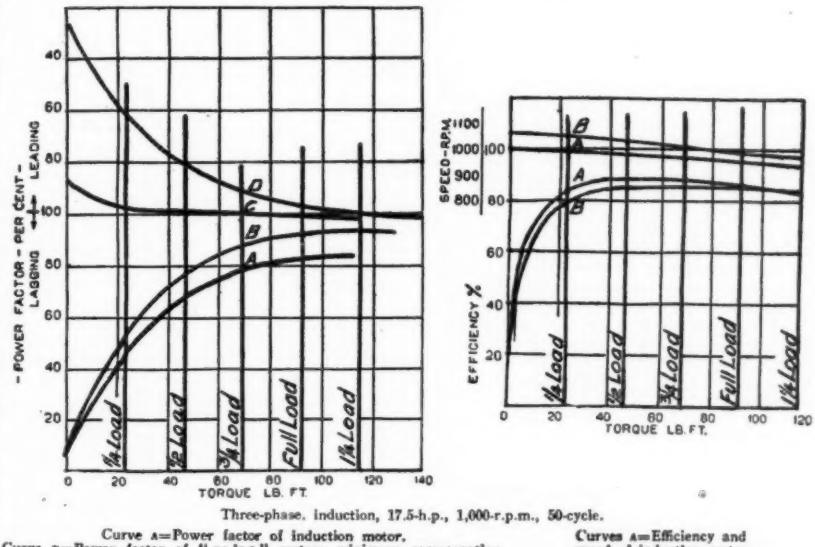
By the use of duplex and open windings for the compensating winding, the volts per segment on the commutator can be kept low, and by running just below synchronism the induced e.m.f. tends to oppose the reactance volts due to commutation, and so the limits in design due to the commutator are raised to such an extent that it is quite possible to build much larger machines than can be utilised as single units for economic reasons. Motors of up to 1,000 h.p. could be built.

Figs. 5 and 6 are typical power factor and efficiency curves for " No Lag " motors, compared with those of an induction motor.

When the " No Lag " motor is adjusted to give unity power factor at full load, the power factor remains at that figure practically down to half load, when it gradually becomes leading. When built to have a leading power factor at full load, the power factor at fractional loads becomes leading much more rapidly. In fact, the motor takes a leading kVA which is nearly independent of changes in load. The efficiency is seen to compare very favourably with that of an induction motor.

As would be expected, its simpler construction enables the " No Lag " motor to be built much more cheaply than a variable-speed a.c. commutator motor, and if used where there is a substantial rebate for good power factor, its additional cost over that of an induction motor can be saved on the power bill in a few months.

It has a better starting performance as regards torque and current than an induction motor, and lends itself readily to the standard forms of enclosure. It can, therefore, be used on most industrial drives with satisfaction.



Three-phase, Induction, 17.5-h.p., 1,000-r.p.m., 50-cycle.

Curve A=Power factor of induction motor.
Curve B=Power factor of " no-lag " motor; minimum compensation.
Curve C=Power factor of " no-lag " motor; unity power factor.
Curve D=Power factor of " no-lag " motor; maximum compensation.

Curves A=Efficiency and speed of induction motor.
Curves B=Efficiency and speed of " no-lag " motor at unity P.F.

Figs. 5 and 6.—Power Factor and Efficiency Curves.

Discussion.

Lantern slides were shown of these types of machine in use up to 300 h.p. for the " No Lag " motor. Some diagrams were shown of the rotor windings of the Schrage motor, indicating how they could be arranged for improving the commutation.

Several speakers took part in the discussion, the principal points elicited being that the cost of the Schrage motor was

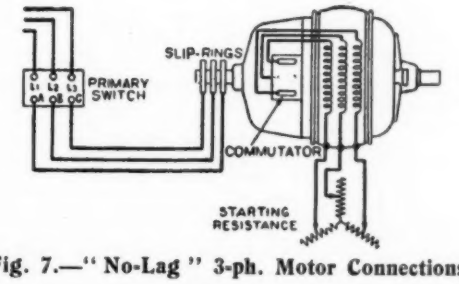


Fig. 7.—" No-Lag " 3-ph. Motor Connections.

from two to three times that of the slip-ring motor; that, however, it was stated, being due partly to the extreme reduction in price of the latter, due to competition. The " No Lag " motor was stated to cost from 30 to 40 per cent. more than the induction motor.

The National Physical Laboratory.

Abstract of the Annual Report of the Executive Committee for the Year 1928.

(*Concluded from p. 806.*)

Among the many matters of interest deserving mention in connection with the work of the electricity department, the most conspicuous are the completion of the high-voltage plant, the progress made with the redetermination of the electrical units, and the international agreement and adjustment reached, as a provisional measure, in the photometry of high-efficiency lamps. The staff in the electrotechnics division has devoted much time to the development of measuring apparatus for use in high-voltage work, and to the provision of the many items of equipment needed to complete the high-voltage installation. It has been possible to make for firms, as well as for investigatory purposes, breakdown tests on strings of insulators up to the full capacity of the plant, and experimental work has been in progress with a view to improvement in methods of measurement of peak voltage in a.c. circuits, by using, after rectification, the current induced in a conductor by the voltage to be measured. A resistor for measurements up to 150,000 volts has been designed and is under construction, as well as a shielded resistor for 40,000 volts for use as a potential divider. The division has also effected a number of improvements in the methods ordinarily employed in tests and investigations for industrial firms. A low-range electrostatic voltmeter has been constructed on the same principle as those in use for the range 50 to 150 volts. The new instrument gives a scale deflection of 5.5 metres at 50 volts, and can be read to one part in a thousand at 10 volts. A set of shielded resistances has been constructed for use in audio-frequency bridge work, ranging from 1 to 50,000 ohms. Air-cooled standard wire resistances for alternating current measurements have been prepared, to replace the water-cooled manganin tubes formerly employed. The resistance for large direct currents has been completed, and will probably serve for measurements up to 15,000 amperes. Some special uses of transformers for measuring purposes have been explored, and the potentiometer electrostatic method for testing voltage transformers has been further tried and found to yield very satisfactory results. The value of "ohmal" for the construction of standard resistances has been confirmed, and 24 such resistances have been under observation; other resistance materials have been studied. The work on the earthing of electric circuits was brought to an end during the year, and a report has been presented to the Wiring Rules Committee of the Institution of Electrical Engineers. A comprehensive investigation has been made into the effective resistance of lead-covered cables when carrying alternating currents, and will be published by the Institution. Researches on the effects of heating and on the dielectric losses in cables at high voltages have been in progress for the British Electrical and Allied Industries Research Association.

In the electrical measurements division very satisfactory progress has been made with the work on the electrical units and standards. The Lorenz machine has been put in order for a redetermination of the ohm in absolute measure, and the experiments will shortly be begun. Much has been done also towards the provision of the necessary equipment for the determination of the ohm by the alternating current method devised by A. Campbell. If good agreement is secured between these two methods, knowledge of the value of the absolute ohm will be established on a very satisfactory basis. An intercomparison of all the standard resistance coils of the Laboratory has also been completed, and a study is in progress of the change in resistance with time of newly constructed standards. The current balance is undergoing reconstruction in an improved form, and it is hoped to reassemble it in the coming year. Measurements showing good agreement with those previously obtained were made with the balance before dismantling it. The results of the work on standard cells, including intercomparisons with other national laboratories, are regarded as satisfactory.

The account given of an international comparison, between the Bureau of Standards (U.S.A.) and the National Physical Laboratory, of measurements on a subdivided mica condenser sent to Teddington from the Bureau, will be found of interest. The results show good agreement in power factor, but a definite difference in the capacity measurements; experiments are proceeding with a view to the explanation of the latter. A number of additions to the equipment for magnetic measurements have been provided to extend the range within which measurements of hysteresis loops and of total loss can be made. Under the heading of research are included some nine investigations of varied interest. The vertical force magnetometer described in previous reports has been set up at the Abinger magnetic observatory. The measurements have shown variations, due, it is believed, to changes in the temperature of the hut in which the magnetometer is housed, which have amounted to several parts in 10,000 in six months. The work on the dielectric constant of benzene has been completed. The method devised for the comparative measurement of input and output voltages on an amplifying system has been brought into operation, and found to give satisfactory results.

A considerable amount of work relating to radio standards has been accomplished for the Radio Research Board. A critical *résumé* of the literature on piezo-electric crystals has been prepared, as well as an account of a mathematical examination into the relationship between the piezo-electric and the dynamical properties of resonators. The interferometer method of examination of vibrating crystal plates has been developed with much skill, and has led to results of great interest.

The photometry division has a considerable programme of work in hand for the Illumination Research Committee of the Department. The main research into the effect of glare on the brightness difference threshold has been completed, and a paper on the results has been presented to the Royal Society.* A series of tests for estimating glare and visibility in lighted streets was organised in July, in connection with the Sheffield meeting of the Association of Public Lighting Engineers, and has yielded interesting information. The study of methods of photo-electric photometry has been continued, and a considerable advance has been made in establishing the use of the photo-electric cell on a reliable basis. For work of the highest precision the original photometer, consisting of a bridge arrangement of two photo-electric cells used with a Compton electrometer, continues to give the best results. Modifications have been made to overcome fatigue effects in the cells. The photo-electric cell is also employed for obtaining continuous daylight records.

In the wireless division good progress has been made with the programme approved by the Radio Research Board. A number of papers have been published during the year giving the results of researches completed. An interesting series of experiments has been carried out on antenna systems for beam transmission. In addition to study of the conditions affecting the "sharpness of directivity" of the system, experiments have been made in an aeroplane to check the calculations of the polar radiation diagrams of antenna systems in a vertical plane. Help has been given by the Air Ministry by the loan of an aeroplane for this work. Differences have been found from the theoretical energy distribution, and the work is being continued with a view to obtaining an explanation of these. For research on wave-lengths below 25 metres, a special oscillator, in which two 250-W valves are used, has been installed at Slough, and a portable loop receiver has been constructed for use at Teddington. It is possible to hold the note in this constant to about 100 cycles per second, corresponding, for 7 metres wave-length, to a constancy of 1 in 100,000. A portable direction-finder for use on wave-lengths between 5 and 10 metres has also been provided. In the continuation of the research on directional wireless, attention has been directed mainly to elucidation of the causes of error in the performance of a rotating loop beacon, and the development of a rotating transmitter free from night errors. The coastal deviation of wireless waves has also been further investigated.

By the desire of the Radio Research Board a critical review has been prepared of the literature from 1916 to 1928 on radio receivers. The investigation of interference has been brought to a conclusion and a report has been prepared for publication.

A large proportion of the research in progress in the engineering department is done to programmes controlled by various boards and committees of the research department, or by outside bodies. The work on lubrication has included the investigation of the limit of pressure under which grease lubrication can be maintained; owing to melting of the grease, the lubrication improves for a slow feed as the temperature rises, and for best results the quantity fed must be made to depend on the temperature. Boundary lubrication for surfaces under relative reciprocating motion has been further studied. The research on "creep" in metals at the high temperatures reached in modern high-efficiency steam turbines and power plant has attained considerable dimensions, the work for the departmental committee having been supplemented by investigations undertaken for firms and outside bodies. The behaviour at high temperatures of a large number of commonly used materials has been investigated, and, in conjunction with the metallurgy department, a programme of work is in hand on new alloys for service at high temperatures.

The experiments on fatigue phenomena exhibited by single metallic crystals of various forms have now reached the point at which prediction of the manner in which failure under stress will occur can be made with confidence when the atomic

* W. S. Stiles, "The Effect of Glare on the Brightness Difference Threshold," presented to the Royal Society, 1929.

structure, as revealed by X-ray methods, is known. The research is of very great interest, and has been carried through with much ingenuity and technical skill by the staff concerned. A general account of the work was given by Dr. Gough in a series of Cantor lectures delivered before the Royal Society of Arts in February, 1928.

Research in the metallurgy department has been proceeding during the past few years along certain well-defined lines, and has been mainly directed to obtaining information of a fundamental character concerning the manner in which the properties of metals and alloys are dependent upon their constitution and their atomic structure, and the extent to which that structure and the related properties are modified by variation in the proportions of the constituents, by impurities, and by heat and mechanical treatment. The procedure is unavoidably lengthy, and involves much subsidiary work in the study of different types of furnace, of methods of production and purification, of refractories for the lining of furnaces and for the construction of suitable containers which will not contaminate the product, of methods of analysis, chemical, spectroscopic, micrographic and X-ray, and of suitable procedure for correlating the physical structure with the heat and mechanical treatment. Work has been directed of late years to the production of pure iron and pure chromium, and much experience has been gained which is of great importance for other work beyond the immediate problem under attack. In particular, attention has been successfully given to the removal of oxygen. Manganese and silicon have also been produced in a condition of high purity, and in connection with the research on minor metals a considerable amount of time has been spent on the production of pure beryllium, cadmium and titanium. New types and designs of furnace have been devised for this work, especially vacuum furnaces of the valve-controlled high-frequency electrical type.

Concrete Overhead-line Poles.

Their practical uses and tests, based upon a serial report of the Overhead Systems Committee, 1928-1929, of the National Electric Light Association, U.S.A.

(A report of a meeting of the OVERHEAD LINES ASSOCIATION.)

AT the meeting of the Association which was held in London on April 24th, Mr. W. Fennell (president) in the chair, an invitation to hold a meeting in the north Midlands to visit the area of the Mid-Cheshire Co. was cordially accepted, and the thanks of the meeting were accorded to the directors of the president's company for the invitation. It is proposed to hold the meeting early in July.

Railway Wayleaves.

As the result of a discussion concerning wayleaves over railway property, it was decided on the motion of Mr. F. Swarbrick, seconded by Mr. R. Borlase Matthews, that the Association should, if possible in conjunction with other interested parties, endeavour to arrange with the railway companies a standard wayleave over their property.

Concrete Poles.

Mr. H. Napier Prentice then took the chair, while the president read his paper on the above subject, pointing out that although they had heard much about concrete poles in France, there was a strange shortage of data. In England, they could not obtain a quotation for poles to resist any particular stress, but a committee had been formed by the British Electrical and Allied Industries Research Association charged with the duty of testing ferro-concrete poles, and Mr. F. Swarbrick was the Association's representative on that committee, but no one seemed to know quite how to commence the British investigation.

The report of the Overhead Systems Committee of the National Electric Light Association commenced by stating that the electric railway companies (U.S.A.) had made considerable use of such poles, but there had been relatively little use of them by power companies; shortage of timber of suitable size had now made the subject a live one. At the present time 33 power companies used concrete poles and 169 did not. Of the 33 companies, 11 made their own, and 5 purchased them for line poles, while the remainder used them for street-lighting standards. All information furnished seemed to indicate a tendency to use concrete poles for fairly low-voltage lines (600 volts), which appeared to be due to the reliance placed in the U.S.A. upon the pole itself to assist the insulator, so that in the U.S.A. the earthing of metal work was not usual, and a conducting pole was avoided for high-pressure work. As they in Britain must earth the insulator pins and must also be prepared to earth the ferro-concrete poles at pressure above 600 volts, its conducting qualities were no disadvantage.

Mr. Fennell dealt with the importance of deterioration and said that twenty users in America reported on deterioration experience with various kinds of concrete poles. Thirteen users reported poles satisfactory, showing no deterioration in from five to seventeen years. Two poles in Schenectady were reported to be thirty years old and in good condition. Seven users reported some deterioration, the causes being as follows:—(1) Steel reinforcing too close to the surface, *i.e.*, less than ¾ in.; (2) porous concrete, due to the use of too much water at the time of mixing; (3) voids in concrete, due to insufficient working, or puddling, of the concrete after placing it in the forms; (4) improper curing, *i.e.*, allowing poles to dry instead of keeping them wet for the first ten days after manufacture; (5) overloading, which was shown up by the appearance of evenly distributed cracks across the pole on the tension side, usually at, or slightly above, the ground line.

The remedies for those causes of deterioration appeared to be:—(1) Steel should be at least ¾ in. below the surface, preferably 1 in.; (2) concrete mixture should be waterproof, by designing the mix for a compressive strength of 3,000 lb. per sq. in.; (3) concrete should be worked and puddled after placing it in the forms, to prevent voids; (4) poles should be cured damp, or wet, for at least ten days; this alone strengthened the concrete 75 per cent. over any unprotected curing; (5) poles should not be loaded beyond the strength for which they were designed.

An investigation conducted by the Power Distribution Committee of the American Electric Railway Engineering Association brought out the following facts in connection with the strength of concrete poles:—(1) Failure of a pole was always due to the stretching of the reinforcing rods on the tension side. (2) A failure was always preceded by the appearance of hairline cracks in the concrete on the tension side, at rather frequent intervals from the ground line up. (3) It was advantageous to use a high grade of reinforcing steel to secure the maximum tensile strength. (4) Plain round reinforcing rods were essentially as satisfactory as twisted, or other rough, rods, because, in general, the rods would elongate before they slipped in the concrete. (5) A large number of small rods was preferable to a small number of large rods, as better distributed reinforcement might be secured for a given amount of steel, and a better bonding contact surface was presented to the concrete. (6) The reinforcement need not be uniform throughout the length of the pole, but might be stepped off as the top of the pole was approached. (7) A pole with uniform reinforcement would break at the ground line, while one with tapered reinforcement would break at some point above the ground, depending upon the taper of the reinforcement. (8) A concrete pole had an element of safety in it, as a failure of the pole would not in general allow it to fall to the ground. It was difficult at times to pull over a pole after failure, even though it was inclined at a large angle from the vertical.

Dealing with cost, the Report indicated that concrete poles appeared to cost from 1½ to 3 times as much as wood poles, and Westinghouse Hollowspun poles are reported to cost approximately the same as tubular steel poles.

The reasons given in the Report for considering concrete poles superior to wood or steel poles were:—(1) Good appearance, (2) durability if properly manufactured and loaded, (3) low maintenance. One user reported that concrete poles were unsuitable for use in city streets because of changing street lines, the poles being unhandy to move. One reply from Fall River, Mass., reported that concrete poles could not be used because of a State law which stated that any type of pole other than wood which carried wires at over 500 volts must be marked "Dangerous." The Report concluded by pointing out that in the design and manufacture of concrete poles the following factors should be considered:—(1) It was an advantage to use high-grade reinforcing steel; (2) poles should be designed so that the maximum load carried would be below the elastic limit; (3) the concrete used gave the pole its enduring properties, and the design and manufacture of the mixture should be carried out carefully. A mixture designed for 3,000 lb. per sq. in. compressive strength would be watertight and would not be affected by the elements. The materials used should be of the best, and the placing and curing of the concrete should be done with the greatest care.

It was apparent, continued the author, that concrete poles properly designed and manufactured were a very satisfactory product with an indefinitely long life. The question was, could they afford the luxury of concrete poles over here? Making full allowance for the slightly higher cost of wood poles over here, as compared with the U.S.A., due chiefly to their more elaborate creosoting, Mr. Fennell expressed the view that they were best for equal strength and height, especially in the smaller sizes. They were not, however, and never would be, allowed to run heavy lines along even medium-sized town streets, the tendency in this country being to reserve overhead work for outer suburbs and rural areas, so that unless a ferro-

concrete pole were offered at about 1½ times the cost of a similar "medium" wood pole, delivered on site, there was every reason why it should not be used. According to Mr. Fennell's judgment, the ferro-concrete pole would not enter into British rural schemes; its weight and cost of handling must be heavy, and the total cost prohibitive; moreover, its surface weathered in a rather disagreeable way. Its finish was associated with that of "artificial" stone. It did not "melt" into the landscape of England, as did a light brown creosoted pole, nor was it suitable for a country town. It ought to be acceptable in a housing scheme, or at a new seaside watering place, or along a railway, or in a power station, or in the vicinity of concrete fencing posts. In helping the development of overhead lines, it was necessary to cut out everything which added to the present too-high cost of high lines. They were not concerned very much with trunk lines, for which, however, the galvanised-steel structure was an easy first in most climates. There was no doubt, however, that ferro-concrete formed a very suitable medium for combined terminal towers and sub-stations in, or near, towns, and several of the mid-Cheshire sub-stations could have been built of ferro-concrete with advantage, if he had been building twenty structures, instead of three or four.

Discussion.

Major T. Rich considered it unfortunate that the president should have examined the subject of concrete poles in relation to a country—the U.S.A.—which in that respect was now in the position reached by some of the Continental countries about fifteen years ago. If one examined some of the American methods illustrated, one might well come to the conclusion that in connection with the scientific design and construction of concrete poles the Americans were not up to date. The square hollow concrete pole was tried before the war by Mons. Delamarche in Grenoble (who was about the original pioneer of concrete posts on the Continent), but that type was abandoned after some years. A concrete pole, if properly designed, was not necessarily exceedingly heavy; when one bore in mind that there were 750,000 concrete poles in use in France (a country in which a very material amount of timber was available) one would come to the conclusion that there must be something wrong with the president's conclusion that concrete poles were impracticable. The reason why there were so many of those poles in France was that they were properly designed as structures. Centrifugally-made concrete poles as high as 90 ft. had been made; centrifugal posts were used in Italy for 240,000-volt transmission. Messrs. Dyckerhoff & Widmann, of Dresden, were about the earliest makers of centrifugal concrete posts, and they were making such posts from 60 to 70 ft. long, and had transported them by train ferry to Sweden.

The President said the makers of the Kisse poles were making them up to 40 ft. long. They did not want poles 90 ft. long in this country, he believed.

Major Rich, discussing the manufacture of the centrifugally-made concrete poles, said that if the concrete were used in the form of a "pudding" there was no necessity for a core at all. The method of the Westinghouse Co. seemed distinctly crude, as compared with the German method. Some concrete posts were used in France for h.p. light rural lines, having a height of about 10 metres (33 ft.) and weighing about half a ton. If they in this country were allowed to adopt the same factors of safety as had been found satisfactory in other countries, he saw no reason why they should not obtain concrete poles in this country at a cost less than one-and-a-half times that of foreign wooden poles. On the Continent, by the use of special jigs and special methods, they could make a frame for a concrete post about 30 ft. high in a few minutes, and the work was done so quickly that the labour cost was exceedingly low. With regard to factors of safety, he said that in England it was 2½ or 3½, based on the elastic limit, and it was the same for wood as for concrete. Wood had practically no reserve of strength beyond the elastic limit; concrete had a big reserve, but it was given no credit for that in the factor of safety adopted. For climbing concrete poles, the Germans used a climbing iron somewhat like that used for climbing wooden poles. Discussing the question of the development of cracks in concrete, he said he believed it was the policy of some German makers to test every pole before it was despatched from the works. The Continental pole maker did not as a rule pretend that concrete would take any material stress in tension, and did not deny that if a pole were stressed to the ultimate strength specified, hair cracks would develop on the tension side. Immediately the load was taken off, however, the hair cracks would disappear, and as the result of their 25 years experience the makers claimed that the hair cracks did no harm. He was interested to hear from the president that round reinforcing rods were just as good as square, or other shaped, rods, and believed it had been fairly well proved that the provision of notched bars, and so on, in reinforced concrete work represented a waste of money. With regard to curing, he had seen posts made with aluminous cement concrete taken out of the moulds seven hours after casting; in summer time a high-class Portland cement was used, and the poles were taken out regularly once a day. He had seen poles carried on a cross bar on a lorry over roads which were very little better than dirt tracks, and the manufacturers did not consider that the poles would deteriorate as the result of that treatment. Finally, he urged that if concrete poles were properly made they would not spoil the landscape.

Mr. W. A. Turnbull expressed himself as being in agreement with the president throughout. Commenting on his remark that the steel in reinforced-concrete poles did not get a chance of taking the strain, he suggested subjecting the rods to initial stress. When they could get a reinforced-concrete pole, the concrete of which would take the enormous strain that it was capable of taking, so that it would bear its fair portion of the load, they would get lighter and more lasting poles.

Major T. Rich drew attention to the fact that large business was being done in Spain, France, and elsewhere with concrete bases for wooden poles. They were being made in France and sold at a price amounting to a comparatively few shillings each.

Mr. F. Swarbrick, who declared himself to be an enthusiast with regard to concrete poles, said that one important aspect of the development of such poles was the possibility of the establishment of a new industry in this country. In his opinion the Continental concrete pole was of very much better appearance than the creosoted wooden pole. He agreed with the remarks of Major Rich with regard to the light concrete pole he had referred to. The prices mentioned by the president were certainly prohibitive, and not comparable with the prices of French poles. Before the end of the present summer there would be in operation in this country an experimental line constructed on the Continental basis, with concrete poles. As a country, they could not afford so conservative a factor of safety as 3½ when they had evidence that on the Continent a factor of safety of 2½, or less, filled the bill. While they were importing and using wooden poles they were neglecting the possibilities of the utilisation of their own materials.

Mr. H. W. Grimmett said that in South Wales there was a very good double-circuit line on concrete poles, erected in about 1919. The cost of the poles at that time was about five times the cost of wooden poles to-day. The concrete poles used had bevelled corners, there being reinforcing rods at each corner. They were made locally and carted to the points at which they were erected. The carting was very expensive, and the best method of transport was horse transport.

Mr. Molle confirmed Major Rich's remarks about the large number of concrete poles used in France. When he was at Grenoble University about eight years ago a long course of instruction was given on the manufacture of concrete poles. Five or six years ago concrete signal poles were used on the railways in India, but not much pull was imposed upon them for that purpose; they were used extensively on the railways in this country to-day. Had anyone had experience of the Marriott pole, which was invented by a railway engineer in this country? It consisted of a series of hollow sections, each section being cast separately, as drain pipes were cast. In the walls of the pole there were holes running throughout the whole length, at intervals round the circumference, and through those holes reinforcing rods were threaded. Each section of the pole could be carried to the site on a bar held by two men; the reinforcing rods were threaded through the sections to make the complete pole, and were bolted up at each end, so that the complete pole was a hollow tube held together by half a dozen, or so, reinforcing rods.

Mr. Minton asked if consideration had been given to the problem of adding colouring matter to the concrete. Green, he said, was about the cheapest colouring matter, and could be obtained for about one penny per lb. Experiments had shown that 1 lb. would be sufficient for about 2 cwt. of concrete.

Major T. Rich said that several of the Continental firms producing concrete posts were also making a large number of concrete candelabra for the streets. They decorated them with coloured concrete on the outside. Tramway and other posts were made of concrete with colouring material in it.

The Chairman could not help feeling that there was a great future for ferro-concrete poles. This country was not yet electrified; they did not yet know where the loads would be and where the lines were going. They ought to give every consideration to ferro-concrete poles for the future, but ought to develop the country on wooden-pole lines, and build up a load which would enable them to afford the expenditure on the more permanent, and possibly more beautiful, ferro-concrete pole lines which, he hoped, would be designed for future use.

The President, replying to the discussion, wished they could obtain figures and information relative to the French construction methods and the results of tests on the French poles. At heart he agreed with a good deal of what Major Rich had stated, but he had considered the problem from the point of view of a body of Electricity Commissioners, bearing in mind the factors of safety that were specified. The details of proposed schemes had to be "quizzed" by the Commissioners, and stress diagrams had to be produced. It must be shown that on the tension side the loads which would be applied by hypothetical gales and hypothetical ice would be well below the breaking stress, or elastic limit. That was the basis they had to work to; they might discredit that basis by showing that it did not allow them in this country to do what was done in others with apparent safety. With regard to underground lines, leading principles were laid down and the responsibility was left to the engineer concerned, and if that were done with regard to overhead work they would be able to make more progress. In overhead work one was not allowed to be an engineer, notwithstanding one's training, and one had to do what one was told to do. Perhaps it was not fair to blame the Commissioners at the present stage, and one of the principal objects in investigating those matters was to demonstrate that with regard to overhead lines engineers could be treated as they were with regard to underground lines, and that they were men who knew their jobs. While they did not object to

a factor of safety of 2½ in the case of a steel pole, they could not expect to be allowed a lower factor of safety for a ferro-concrete pole.

Major RICH said that a concrete pole was stronger than a steel pole in compression.

The PRESIDENT replied that one must demonstrate that.

The CHAIRMAN pointed out that in the ferro-concrete pole the steel was protected from corrosion.

The PRESIDENT replied that, under the regulations, the steel-work must be painted regularly. The factor of safety of 2½ was demanded, not merely when the pole was new, but always.

Major RICH said the factor of safety for ferro-concrete was 3½, as compared with 2½ for steel; it should be the other way round.

The PRESIDENT agreed that the higher factor of safety for ferro-concrete was a handicap, and that was what he had wanted to emphasise in the paper. Centrifugally-made poles should be spun so quickly that some real action was exerted by centrifugal force, not merely by compression of the concrete in the early stages of setting. The very light pole, weighing less than half a ton, would not meet the requirements with regard to factor of safety. A 33-ft. pole weighing half a ton would break during the first ordinary gale it experienced, according to the calculations. In the case of the Marriott pole one could put any amount of initial stress on the rods. Where could one get those poles? Pre-stressing was an excellent method. He was not in favour of the argument that all overhead lines were going to be placed underground later on, and looked upon overhead lines as permanent equipment, certainly for the more rural parts of the country, for many years hence. The point made by Mr. Swarbrick with regard to the establishment of a new industry in this country was an important one, and they ought to sacrifice something to that end. If anyone could show him a ferro-concrete pole made in this country, even though it were 50 per cent. more expensive than an imported wooden pole, he would think about it very seriously. With regard to the high cost of the concrete-pole line in South Wales, referred to by Mr. Grimmett, the installation was probably much stronger than it need be and the high cost was due to that fact. Those who had erected the line were pioneers, and no doubt were anxious to ensure that it would not fail. The worst form of engineering in his view, was that which never failed. Colouring matter in concrete would fade when exposed to sunlight.

A Mobile X-Ray Installation.

The equipment described below is believed to be the first of its kind to be specially designed and built for public health purposes.

X-RAYS, LTD., have under construction, and nearing completion, for a public health authority, a mobile X-ray outfit specially designed for use in rural districts, and the installation is believed to be the first of its kind to be built for public health purposes at reasonable cost and for economical operation. The unit consists essentially of a one-ton Morris motor-car chassis and a special body accommodating all the apparatus for the complete production of X-ray negatives at any place to which a motor car can be driven. The chassis is fitted with a four-cylinder 14/28-h.p. engine, and the special body has internal space of 8 ft. by 6 ft. by 6 ft. Two large end doors give complete access to the car. At the foremost part of the body a partition provides the necessary dark room, and the other portion of the body is utilised for carrying the X-ray equipment. A cupboard is provided for taking the various accessories, cassettes, screens, Potter-Bucky diaphragm, &c., and on one side of the top is a drum which carries 50 yd. of cab-tire flexible cable. The cable passes through the roof of the car and is carried over the pavement by means of a swing arm attached on the outside of the car, giving a span of 9 ft. The connection to the cable is provided on the drum, so that it is only necessary to unwind the required amount of wire from the drum. The outside end of the cable is provided with a plug for connection to the control switchboard. The chassis is also fitted with a 2.7-kVA self-exciting alternator, driven from the car engine, for the power supply. The generator is arranged so that it is accessible for inspection and cleaning, but at the same time it is fully protected against the weather. A distribution switchboard is provided inside the car at a convenient position for the driver, so that all wiring is made "dead" while the apparatus is being fitted up or dismantled. A telephone is provided between the operator and the driver.

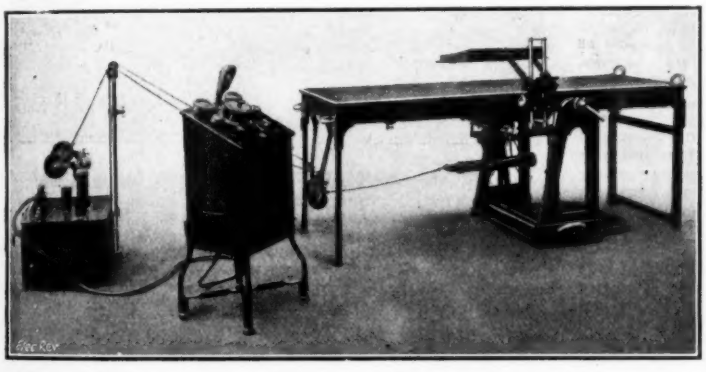


Fig. 1.—X-ray Apparatus for Operation in Horizontal Position.

A step-up high-pressure transformer will give a secondary pressure of 65,000 V (r.m.s.) and is provided with suitable high-pressure pillars for connection to the X-ray tube. The transformer is capable of giving 30 milliamperes output through a hot-cathode type of tube. A separate step-down transformer is fitted in the same tank for heating the filament of the hot-cathode tube. Primary connections to the step-up transformer and the filament current transformer are provided by a multiple-plug connection fitted with a flexible cab-tire lead connecting to the control table. This is fitted with a sloping paxolin top on which the following instruments are mounted: kilovoltmeter for indicating the voltage applied to the X-ray tube; milliammeter for indicating the current passing through the tube; pilot light for showing whether the switchboard is alive; auto-transformer selector switch for varying the voltage applied to the X-ray tube; switch and regulator for varying the filament current and the milliamperage passing through the X-ray tube; and a press-type exposure switch and an automatic time control switch for giving timed exposures from one-tenth second to ten seconds. A d.p. main control switch is fitted on the side of the switchboard, and the unit is arranged as a separate control table mounted on leg supports.

A combined couch and screening stand is fitted with a travelling framework moving lengthways of the couch or up and down when in the screening stand position, and is provided with counterweights. The cross frame carries a smaller framework on which is mounted a square-leaved diaphragm with handle controls from the front of the stand for adjusting the aperture in either direction—horizontally or vertically. The cross frame carries the fitting to take a "Metalix" tube, and is arranged with a transverse movement in relation to the couch top, controlled from the front of the stand This travelling framework carries an upright arm on which a fitting is pro-

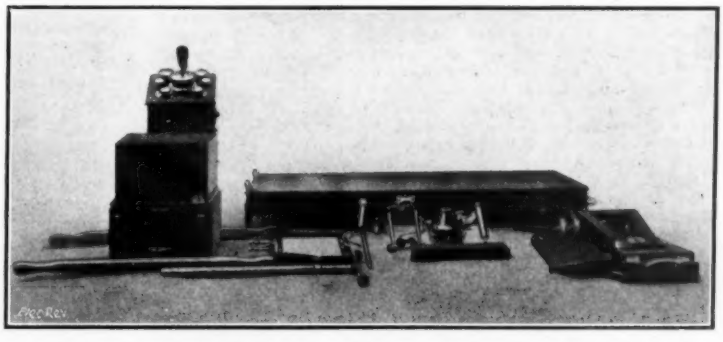


Fig. 2.—X-ray Equipment Dismantled for Repacking into Van.

vided having an adjustable movement for varying the distance from the tube or couch top. The fitting carries a detachable framework which holds the fluorescent screen. It is provided with an angling movement, and is also arranged to take the

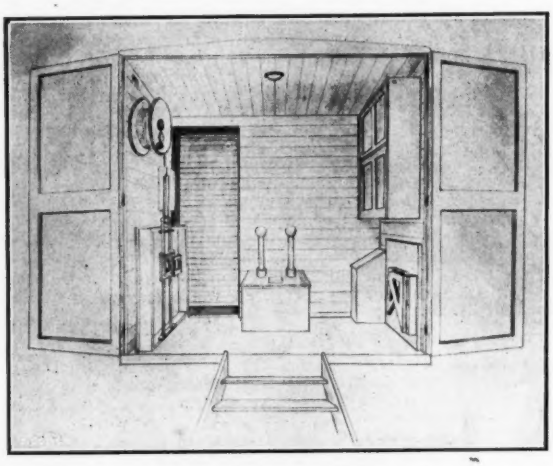


Fig. 3.—Interior of Van of Mobile X-ray Unit.

cassette in place of the fluorescent screen for radiographic work. The screen is fitted with "Super Protex" lead glass giving an equivalent of 2 mm. of metallic lead, and the size is 15 in. by 12 in. An additional fitting is provided for attaching to the upright arm and carries the tube above the patient for radiography from overhead, and has sufficient adjustment for radiography with a Potter-Bucky diaphragm. The framework and base of the combined couch and screening stand is constructed in oak, and is provided with handles for transporting from the car to the room. It is arranged in two units, namely, the base and the couch top, the uprights being hinged to the base for conveniently packing into the car. Suitable handle-type locking clamps are provided for holding the equipment rigid when it is erected. A detachable adjustable upright with a socket fitting is provided for the transformer, and is arranged with deeply-grooved guide wheels for carrying the high-pressure coronaless type spring rheophores conveying the high-pressure current to the X-ray tube, and it is arranged in such a manner that the leads can be connected with the couch and screening stand, either using the tube underneath or overhead, or, alternatively, behind when in use as a screening stand.

The darkroom is provided with a loading bench and a lead-lined sink which accommodates the set of developing, fixing and washing tanks for 15 by 12 films. The tanks are fitted with a removable top which has a clamping device for preventing the fluids from escaping when the car is travelling. An electric darkroom lamp with switch control is fitted in the darkroom. A water tank for carrying a supply of water is provided, together with a hand pump which can be utilised for filling the tank from a low-level supply. Alternatively, there is a filler funnel fitted to the tank which can be filled from outside the car by means of a hose from a high-level supply. A tap is fitted above the sink with a pipe connecting to the water tank. A waste pipe is carried from the sink to underneath the car. A light-tight ventilator is provided in the darkroom and is fitted with an electric fan for extracting the air. Suitable louvres are provided for an inlet of fresh air. There is a plug-switch point off the a.c. mains for a heater.

Fig. 3 depicts the arrangement of the interior of the vehicle; fig. 4 shows the equipment removed from the van and in

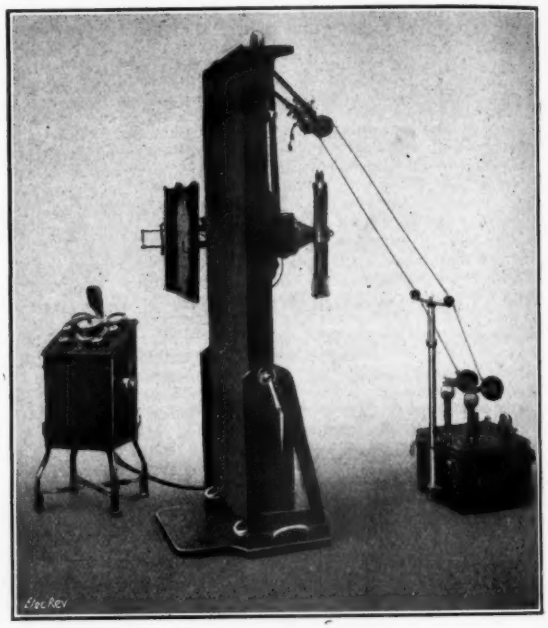


Fig. 4.—X-ray Outfit in Position for Vertical Screening.

position for vertical screening or radiography; in fig. 1 the apparatus is shown for operation in the horizontal position; and fig. 2 shows the outfit dismantled and ready for repacking into the van.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Current Transformers with "Hipernik" Cores.

A new type of current transformer that is suitable for all applications with secondary loadings of up to 50 volt-amperes, at any power factor, and at frequencies of from 25 to 133 cycles per second, for use on pressures up to and including 6,900 volts, has been brought out by the Westinghouse Electric & Manufacturing Co., of America. Greater accuracy is obtained in this transformer by using "hipernik" instead of silicon-steel for the core. "Hipernik," which is an alloy made of pure nickel and electrolytic iron, specially treated, is non-ageing, and has, it is claimed, three times the permeability of regular silicon-steel and only half the losses. The primary of the transformer is wound with a sufficient number of ampere-turns to assure good and like performance at all ratios. The primary element is almost circular, thus assuring strong mechanical construction. The coils have low current rating and are made of light copper strap, but up to 100 A they are provided with two terminals of sturdy copper strap, ¼ by 1 in., with bolt holes for terminal lugs. The secondary coil is circular, and the leads are brought out to a terminal block. It is properly insulated from the primary coil to withstand a test pressure at 20,000 volts. A secondary terminal block with a suitable cover is provided on which are fixed studs to which the wiring of meters, instruments and relays may be connected. The transformer is claimed to be considerably lighter than similar ones with silicon-steel cores, and it will withstand, mechanically, it is claimed, short-circuit currents of up to 70 times the normal primary rating. The time limit due to thermal capacity of this type of transformer is half-a-second for this current. The transformer is available in sizes ranging from 5 to 1,200 primary amperes.

New Electric Fans.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is introducing this season a new range of induction electric fans for desk and bracket mounting, fig. 1. These are fitted with shaded-pole, squirrel-cage motors with cast shells, the stators being built up of stampings punched from specially selected steel sheets, and carefully insulated to reduce losses. The stampings are riveted together under pressure, thereby eliminating, it is claimed, any humming being set up through magnetic effects. Self-aligning bearings of ample dimensions are provided for the motors, and lubrication is effected by means of a wick held in position by a self-centring spring. In the base of the fan is a choker-type speed regulator. The blades are punched out of sheet brass, and are so shaped as to give maximum volumetric efficiency. They are balanced both statically and dynamically to obviate troubles due to vibration. The fans are made in two types—non-oscillating and oscillating. The former pattern is adapted for desk or bracket use by means of a trunnion attachment,

and in either position a wide range of adjustment is available. In the oscillating pattern a continuous movement over a wide area is provided by means of special mechanism. Considerable attention has been given to the design and manufacture of ceiling fans for both a.c. and d.c. circuits, and in this respect the G.E.C. has modified its existing range of fans of this type by splitting each type into two patterns, known as the

Fig. 1.—" Magnet " Induction-type Desk Fan.

"distribution" and the "velocity" types. The "distribution" type of ceiling fan is fitted with blades on which the contour is designed to give a distributed breeze over a wide area, while the blades of the " velocity " type are arranged to give a concentrated breeze over a relatively restricted area, thus giving the highest possible air speed.

An Electrical Anemometer.

We have received from Messrs. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering, Northamptonshire, particulars of their latest development, an electrical anemometer. It comprises a small wind dynamo with a directly-coupled propeller and a wind-gauge meter. It is especially suitable for yachts, aerodromes, &c., in connection with which it is necessary to read the velocity of the wind *at any moment*. The dial is graduated in miles per hour. The illustration, fig. 2, shows a portable type which is held in the hand with the propeller facing the wind. Messrs Wilkinson & Partners also supply a

Fig. 2.—A Portable Electrical Anemometer.

stationary type, which comprises the wind dynamo mounted upon a tubular support fitted with a wind direction vane and swivel head, but with the wind-gauge meter installed in any suitable position and connected to the wind dynamo by means of a cable.

Pole-type Transformers.

We have received from BRUCE PEEBLES & CO., LTD., Edinburgh, an interesting illustrated leaflet dealing with their pole-type transformers, which, they point out, are manufactured in all the usual sizes and voltages. Although this publication only extends to eight pages, it is well illustrated, and a very considerable amount of information is given in a compact form. There are lists of the approximate weights and dimensions of all the sizes manufactured, and also three schedules giving technical particulars of pole-mounting transformers for different ranges and voltages. Fig. 3 shows a " Peebles " 15-kVA, 3-phase, 50-cycle, 11,000/415-

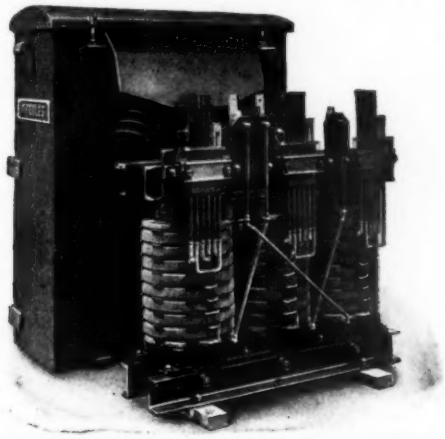


Fig. 3.—Pole-type Transformer; 15 kVA, 3-phase, 11,000/415-240 V.

240-volt pole-mounting transformer fitted with the makers' patent tapping units. It will be noted that the tank is provided with an improved design of h.p. terminal insulator. These transformers are, of course, also manufactured in the platform-mounting type, and they can be fitted with externally-operated tapping switches if required. There are many special features in design and construction fully described in the leaflet, which makes the perusal of a copy wel worth while.

A New Lighting Fitting.

The accompanying illustration, fig. 4, is of an " Essalite " enclosed lighting unit, a recent production of Messrs. SMITH AND ANSELL, LTD., Stockfield Road, Acocks Green, Birmingham. Its feature is the method of suspension contact at the fitting itself. Instead of the usual metal canopy carrying the globe by means of a lip on the latter and screws, studs, with washers,

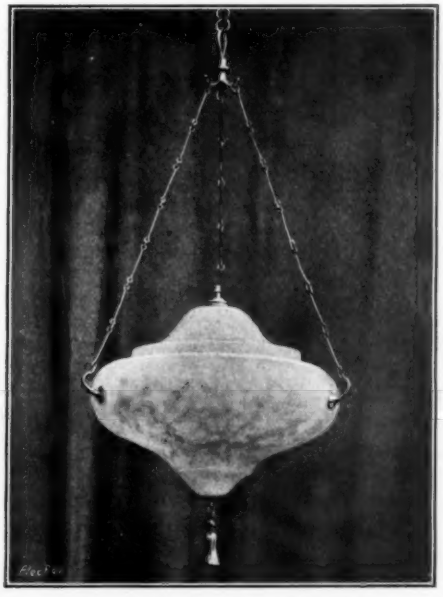


Fig. 4.—" Essalite " Enclosed Lighting Unit.

fitted in the sides of the bowl are hooked by the suspension chains. The bowl is made in two parts, and by simply lifting the top portion the lamp is rendered easily accessible. The fitting is made in two sizes, which may be fitted with " Triply," " Snowflake," " Goldflake " or " Veinflake " glass.

Legal.

The Gasfilled Lamp Patent.

In the Chancery Division, on May 6th, Mr. Justice Luxmoore had before him an application by the British Thomson-Houston Co., Ltd., for an extension of Patent No. 10,918, dated May 8th, 1913, relating to gasfilled incandescent electric lamps. Applicants asked for an extension for five years on the ground that they had suffered loss or damage owing to the war.

Sir A. Colefax, K.C., for the company, said that the patent had been the subject of litigation in this country, and its validity had been upheld by the House of Lords. The incandescent electric lamp at the date of the invention was a vacuum lamp. Lamps made in accordance with the invention contained a gas of low heat conductivity at a relatively high pressure, the filament being one of large diameter or of concentrated form. The common method was to have the filament in spiral form. The purpose of the invention was to enable the filament to be heated to a higher temperature than would otherwise be obtained without prejudicial evaporation. By reason of the higher temperature of the filament a whiter light was produced, and also, with certain sizes and with certain voltages, one got substantially greater efficiency than was possible with vacuum lamps. The invention was made in the United States by a distinguished man in the employ of the General Electric Co. By the time war broke out considerable work had been done in this country by the B.T.H. Co., who were the grantees and registered owners of the patent, in the application of the invention to large-sized lamps, and progress had been made in establishing their manufacture. A matter which had to be borne in mind was that when the war broke out no tungsten was made in this country, and the applicants had to produce it themselves, which was a difficult matter. Moreover, the essential gas for the smaller lamps was argon, and it was mixed with another gas in the larger lamps. In respect of the large lamps, their manufacture as a commercial operation was seriously interfered with, and the necessary work in connection with the application of the invention to smaller sized lamps was brought to a standstill by the war. The smaller sized lamp was the one in which the invention found the greatest use; to-day it constituted 70 per cent. of the actual sales in this country of lamps made in accordance with the invention. The company's works became a controlled establishment in 1915, and remained so till the middle of 1919. The lamp department was largely occupied in making wireless valves and special lamps required for military use. Their licencees were also a controlled establishment, and were engaged on war work. The invention had had a very large application, and large profits had been made since the war. But his case was that the applicants had lost four years of the life of the patent owing to the war. During the war the few lamps made in this country were supplied to the Government, and in 1918 there was an importation of these lamps for Government purposes from Holland.

Notice of objection had been given by Mr. Claude H. Morrell and by Mr. A. H. Gower. Another objector was Lissen, Ltd., who, he understood, desired to withdraw. There was objection by a union of French lamp manufacturers. The Nox Electric Lamp Co. appeared to want a licence, and applicants were not indisposed to grant this company one on certain terms and subject to royalties. Applicants had not refused a licence, except in one case, for good reasons. The other objectors were Tungstalite, Ltd., the Kye Electric Co., Ltd., and the Nelson Electric Co., Ltd. They said that applicants had suffered no loss by reason of the war, but that if they had they had more than recouped their losses since the war. They also said that they objected to the applicants' methods of trading, stating that the prices were too high. Last year 17 million of these lamps were sold in this country, and that did not look as if the prices were too high or as if the public were suffering. Another objection was that large dealers were granted special discounts if they dealt in other lamps made by the applicants.

The patent had been extended to the principal Continental countries, with the exception of France, where quite recently it had been held invalid on the ground of alleged prior publication. The decision was to the subject of appeal.

Affidavit evidence having been read, Sir Duncan Kerly said he was not there to oppose on behalf of the Nox Co., but his contention was that he had a concluded agreement for the grant of a licence, and he would ask his Lordship not to grant an extension unless he had a licence according to the agreement.

The hearing was adjourned.

The Marconi Company's Royalties Appeal.

The hearing of this appeal by Marconi's Wireless Telegraph Co., Ltd., from an order of the Comptroller-General of Patents was resumed by Mr. Justice Luxmoore in the Chancery Division on May 1st. The opening stages were reported in our last issue (p. 810).

Sir Duncan Kerly, K.C., for the Marconi Co., said the Comptroller's decision in substance was that it was contrary to public policy to refuse to grant the applicants (the Brownie Wireless Co.) a licence. He contended that there was no evidence to support the finding, and the proposition that it was contrary to public policy to refuse a particular applicant a licence must be wrong. It was said that 12s. 6d. per valve-holder was too high a royalty; the evidence to establish that must come from the trade, and there was not a scrap of evidence of the kind. It was said that there was a 50 per cent. margin between the retail selling price and the cost of manufacture, and yet it did not pay English manufacturers already in the business to make a reduction in their profits in order to secure an enormous number of imaginary customers who would not pay £7 5s. for a set, but would pay £4 7s. 6d. He asked his Lordship to brush aside all this. It was impossible for the Comptroller, with the evidence before him, to arrive at a sounder conclusion how the Marconi Co. should carry on its business than it had been able to reach in constant discussions with the trade in a period of five years. The wireless trade in this country had grown up under the protection of the Marconi Co., and so far from the suggestion being true that it would be to the advantage of British manufacturers that there should be importation of cheap foreign sets, he contended that British manufacturers attached great importance to the protection they now enjoyed. There was no evidence from the trade as to what was a reasonable or possible royalty. The Comptroller had acted on the suggestion that a Brownie two-valve set would be sold at a cheap price, and one would think that the licence would have been restricted to cheap sets. If the Brownie two-valve set had to be sold at £2 10s. there was no justification for giving the Brownie Co. a general licence. Another objection to the Comptroller's decision was that there was no minimum royalty fixed. A first condition of the grant of a compulsory licence to them ought to have been the fixing of a minimum royalty of £1,000 a year, or something of the sort.

Mr. Trevor Watson, who followed, argued that it was definitely contrary to public policy that a compulsory licence should be granted in any such circumstances as those which existed in this case.

Mr. Moritz, K.C., on behalf of the Brownie Co., said that there were no novel principles involved. Compulsory licences had been part of the law of the country for nearly 50 years. The assumption underlying Sir Duncan's speech was that unless grave reason could be shown to the contrary, a patentee could still do what he liked with his own, but that was a doctrine which had long been exploded. Patent legislation tended more and more to interfere with any such attitude. His contention was that it was in the public interest that a licence should be granted to the Brownie Co. that there had been a refusal by the Marconi Co. to grant a licence on reasonable terms, and that the trade of the Brownie Co. was prejudiced by that refusal. Wireless broadcasting had become a public utility service of the same nature as the telephones, and was now a matter of vital national interest. As for the argument that if his Lordship upheld the Comptroller's decision it would put the Marconi Co. in a position of great difficulty from which there was no escape, he pointed out that the Marconi Co. had publicly announced that if the Comptroller's decision was upheld it would be prepared to grant licences on the same terms to any other manufacturer. The evidence would show that the Brownie Co. was in a position to supply sets at such a price as to place them within the reach of a large section of the public who had never been catered for. Counsel maintained that there had been concealment of the fact that all licences were not alike. Certain firms who could manufacture on a large scale started with the dice loaded in their favour, being granted special terms.

The hearing was resumed on May 2nd, when Mr. Moritz, K.C., continuing his argument, said that Mr. Shoenberg, of the Marconi Co., in his evidence before the Comptroller, said that the "big six" acquiesced in the "A2" form with regard to paying royalties. He (counsel) had evidence negativing that and to the effect that with regard to the British Thomson-Houston Co.—one of the "big six"—it never had paid more than 2s. 6d. per valve-holder by arrangement. He asked that he should be allowed to cross-examine Mr. Shoenberg and to call further evidence on the matter.

Sir Duncan Kerly, K.C., said that as regarded the B.T.H. Co., he was instructed that it paid 10s. royalty, as Mr. Shoenberg said, and it continued to do so down to the time just before the Comptroller's inquiry. Since that time it had made no payments. The matter stood over, and no doubt would be affected by the result of those proceedings. As regarded all the other licencées, until the Brownie application was made they continued to pay. Since that application, with regard to some of the other licencees the matter had also been allowed to stand over. With certain persons dealing with it the Marconi Co. had made arrangements for the interchange or the purchase of rights from those persons, and in a few cases the considerations had some operation on the royalties they had to pay. Those were exceptional cases. He declined to disclose, unless directed by the Court to do so, what those arrangements were, and he submitted that it could not be right for the Court to require the Marconi Co. to disclose its business arrangements with other persons.

The Judge said if Mr. Moritz accepted Sir Duncan's statement that was sufficient. It would not be right to require the Marconi Co. to disclose its business arrangements.

Mr. Moritz agreed that he had no right to a roving inquiry, but Mr. Shoenberg had stated that they issued a uniform licence to large and small manufacturers alike, but in the

case of the "big six," they paid only 10s. royalty. The information that had come into his hands was that that evidence was not true. He wanted to ask specific questions with regard to all the "big six."

The JUDGE said he did not think because Mr. Moritz did not accept the evidence that was a reason for recalling Mr. Shoenberg and cross-examining him about what he said at the inquiry. If the answers were untrue, Mr. Moritz had another course open to him.

Mr. MORITZ asked his Lordship to scrutinise the cross-examination of Mr. Shoenberg with great care and to infer that considerable concessions were made to specific firms, and this was concealed from the general body of the licencees.

Sir DUNCAN KERLY protested against the attack on Mr. Shoenberg, and the JUDGE ruled that there was no ground for adjourning the case for the recall of Mr. Shoenberg or for further evidence. Mr. MORITZ acquiesced.

Mr. STAFFORD CROSSMAN, on behalf of the Comptroller-General, said that he had before him certain confidential figures supplied by the Marconi Co. showing the amount received during the preceding five years from the 12s. 6d. royalty. It seemed to him that his Lordship ought also to have those figures before him.

Mr. MORITZ said he could not object, but he would have liked to have seen the figures and to have asked some questions about them.

Sir DUNCAN KERLY handed in a copy of the figures for the use of the Judge, and said he had no objection to counsel for the Brownie Co. seeing the figures, but they were not to be disclosed to anyone else..

The JUDGE said that no comment must be made which would disclose them. If it was necessary a part of the argument could be heard in private. A copy of the figures was then shown to Mr. Moritz, who afterwards proceeded to read the cross-examination of Mr. Shoenberg at the inquiry before the Comptroller. In his concluding argument he suggested that the Comptroller was entitled to judge that the home constructor was a material consideration. Mr. Barber, of the Brownie Co., said that if the royalty was reduced, home constructors would be induced to buy cheap sets on which royalties had been paid. The Comptroller accepted that view. With regard to public interest, the fact was that there were a large number of people in the country whose means were such that they could pay 50s. for a two-valve set without accessories, but could not pay more. If there was a person who was willing and able to satisfy their requirements it was in the public interest that he should be put in the position to do so, and should be granted a licence. That was the conclusion of the Comptroller-General.

On May 3rd Mr. SHELLEY, continuing the argument on behalf of the Brownie Co., said that a manufacturer could not enter the wireless trade except through the Marconi Co., and it was wholly irrelevant to consider the fact that there were 2,300 licences without considering whether the licence was reasonable. Mr. Barber was prepared to put on the market a two-valve receiver at a price which compared with prices previously obtaining was ridiculous. The evidence was that the average price of a two-valve set had been £5 4s. 6d., and Mr. Barber was going to put on the market a set at £2 10s. He could only do that if the royalty was reduced. He was willing to submit to any clause compelling him, so long as there was a demand for them, to put only the cheap sets on the market.

The suggestion that the effect would be to destroy the sanctity of contract and would mean the nullification of the 2,300 existing licences was beside the point; the legislature had frequently interfered with the sanctity of contract, and the only question was whether the interference was in accordance with what the Legislature had laid down. If Mr. Barber was unable to develop his business because the royalties were maintained at 12s. 6d., it was a restriction on the legitimate extension of his trade, and such a restriction was contrary to public policy.

Sir DUNCAN KERLY, K.C., replying on behalf of the Marconi Co., said that the respondents had endeavoured to make a case with unverified assertions. It was maintained that the Comptroller-General was entitled to act without evidence because he had special knowledge enabling him to do justice in the particular case. This was untrue, for the Comptroller knew no more than the proper evidence put before him, and, in fact, he had not purported to act on anything but evidence. Another point was that there was a large body of people who desired to have valve receivers, but could not afford more than 50s. But the Brownie Co. advertised a crystal set with a note magnifier for 32s. 6d. Where was the evidence that that did not satisfy the demand? The notion that there was a large class of people who would rush in to buy if the royalties were reduced was a false assumption. There was nothing in the Act which said that it would be an abuse of the monopoly rights, leading to the grant of a compulsory licence, if licences were granted on different terms by the patentee.

The hearing was adjourned until Wednesday last.

Spurious "Osram" Lamps.

THE General Electric Co., Ltd., prosecuted in a case at Hull Police Court on April 22nd, when Thomas L. Bower, trading as the Oakenshaw Trading Co., Bradford, was summoned for using the company's trade mark "Osram" in connection with electric incandescent lamps not of the company's manufacture. Defendant pleaded "Not guilty."

Counsel for the company said that it had come to his clients' notice that lamps were being sold which were stamped in a way calculated to lead persons to believe that they were genuine "Osram" lamps, when such was not the case; the offending lamps lasted only a very short time. The lamps in this particular case were marked "Osram Gasfilled, Made in France," whereas the General Electric Co.'s lamps were made in England. The evidence showed that the defendant offered to supply Messrs. Miller & Garness, electrical contractors, Hull, with lamps marked "Osram Gasfilled, Made in France," and that he supplied them with 50 lamps against a cheque for which a receipt was given. Within a week or two the purchasing firm received complaints of lamp failure and communicated with the Hull branch of the General Electric Co., Ltd., with the result that inquiries were instituted and the fraud discovered. A certificate of the registered trade mark "Osram" was produced, while a factory superintendent of the Osram Lamp Works at Hammersmith gave evidence that the offending lamps were not made at those works, and were in fact spurious imitations.

Defendant said that he had been in the lamp business since 1922, and admitted the sale of 50 lamps as alleged by the prosecution, but denied that he knew they bore the offending mark.

The Stipendiary found the defendant guilty of selling lamps improperly marked, and said that the public must be protected. He fined the defendant £15 and £15 15s. costs, or 51 days' imprisonment.

Misuse of "Ediswan" Trade Mark.

AT the Norwich Guildhall Police Court on April 23rd, Roger H. Read (18) pleaded guilty to a charge of falsely applying the trade mark "Royal Ediswan" to lamps not made by the Edison Swan Electric Co., Ltd., the owners of the trade mark.

Mr. C. B. HILL, prosecuting for the company, said that the defendant traded as the "East Anglian Electrical Supplies" at Great Yarmouth. He offered some lamps to a customer, who would not take them as they were of Dutch manufacture, when he wanted British-made lamps. The defendant said he would obtain some British lamps for the customer at the same price as the Dutch ones. He returned with some lamps, which he said were "Royal Ediswan," and the customer made him enter that description on the invoice. The customer found out later that the lamps were marked "Made in Austria." Evidence was given on behalf of the company that the lamps differed in construction from "Royal Ediswan" lamps. A solicitor pleaded for leniency as the defendant had been trying to keep the business going during his father's illness. Two other charges of obtaining money by false pretences were mentioned, and the defendant admitted to them.

The magistrates, in view of his youth, bound defendant over for two years under the supervision of probation officers.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

South-West England Scheme.

On May 1st Colonel WOODCOCK asked the Minister of Transport if he could state the date upon which the scheme for South-West England, now being prepared by the Electricity Commissioners, would be transmitted to the Central Electricity Board; and if the report would be made public without any further delay.

Colonel ASHLEY said he understood that the Commissioners hoped to complete their survey of the large area included in the South-West England and South Wales Electricity Scheme in the autumn, and to transmit the Scheme to the Central Electricity Board before the end of the year. The Board would then proceed to publish it.

The Severn Barrage.

On May 1st Colonel ASHLEY informed Colonel WOODCOCK that the expert committee had presented a report which would shortly be considered by the Severn Barrage Sub-Committee of the Committee of Civil Research.

The Grampian Power Bill.

Owing to the death of Lord Younger, who was chairman of the Select Committee of the House of Lords which had this Bill in hand, the Committee has been discharged and the Bill cannot proceed further in the present session of Parliament.

The Metropolitan Railway Bill.

Opposition to this Bill having been withdrawn, the Unopposed Bill Committee of the House of Lords has passed

it for third reading. The Bill, which empowers the company to raise further capital and to carry out the widening of its lines between Harrow and Wembley Park, has already passed the House of Commons.

The Co-ordination of London Passenger Transport.

On May 1st the Bills designed to secure the co-ordination of the London tramway, Underground and omnibus systems, promoted by the London County Council and the "Underground" group, came before the House of Commons for third reading. Upon consideration of the L.C.C. Bill a number of amendments were moved by Labour members but all were rejected. The amendments were directed at limiting the return on the capital employed; modifying the common fund proposals; and limiting the amount of capital admissible as ranking capital. Sir H. Jackson, who was in charge of the Bill, said that only eleven of the local authorities in the area now opposed the Bill. The promoters had undertaken that after a reasonable return had been paid on the ranking capital the Minister of Transport should have a voice in the disposal of the surplus. Local authorities would be able to appeal to the Minister against any material changes in fares. Immediately upon the passage of the Bills it was intended to promote a Bill for powers to construct an extension of the Piccadilly line northwards from Finsbury Park, as suggested by the London Traffic Advisory Committee. All existing fares and arrangements on the tramways would be continued under the common management, and workmen's fares would be introduced on the omnibuses where this was the sole means of transport. Lord Ashfield had assured the trade unions concerned that none of the "Underground" employés would be prejudiced by the scheme and provision for compensation where necessary had been included in the L.C.C. Bill. A motion for the rejection of the Bill was negatived and the measure was read a third time. The other Bill also received its third reading.

The Bills were read a first time in the House of Lords on May 3rd.

The Underground Railways Bill.

The Bill which has been promoted by the City and South London, London Electric & Metropolitan District Railway Companies has been referred to the Unopposed Bill Committee of the House of Lords, the opposition having been withdrawn upon terms.

A Scottish Case.

On May 2nd, Mr. WESTWOOD asked the Minister of Transport what action, if any, he proposed in connection with the petition from users of electricity in Bonnyrigg, Midlothian, requesting his intervention to determine what fee should be charged for hire of electricity meters in the burgh of Bonnyrigg; and if he was aware that the fee charged was 8s. per year for light meters and 12s. per year for power meters.

Colonel ASHLEY said that the Electricity Commissioners informed him that they were in communication with the electricity undertakers concerned, and hoped shortly to be in a position to determine the matter.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Telephone Development.

We have been reading with much interest your article on telephone development in your issue dated April 26th.

It is quite true, as you say, that an enormous amount of propaganda work remains to be done. One detects a certain amount of complacency about recent official dicta about the record growth in the actual number of telephones in use, but the fact remains that the percentage rate of growth, the real test, is not going up, the figure for the last four years, ended December 31st, in each case being: 1925, 9.2 per cent.; 1926, 8.7 per cent.; 1927, 8.2 per cent.; 1928, 7.7 per cent.; and a very careful study of the growth figures, both actual and percentage, during the last decade leaves the impression that the results recorded represent the rate at which the Post Office is supplying the demand for telephones rather than the rate at which the demand for telephone service from the public is increasing.

Of course, what the assistant Postmaster-General described as the "shackles put upon the Post Office by the Exchequer" may have a good deal to do with the even flatness of the growth chart which we keep here, though this is difficult to reconcile with the Postmaster-General's more recent statement that he had had all the money he had asked for from the Treasury, the deduction from which is that he did not ask for enough, otherwise we should not find in a district surveyor's annual progress report, compiled for the information of the Telephone Advisory Committee, such a reference as the following: "The restriction of capital expenditure, due to the urgent need for national economy, has curtailed the constructional activities of the Engineering Department."

You point out, further, that political capital is now being made out of this question of intensifying the programme of development of the telephone system as a contribution to the problem of unemployment. We here have very carefully examined the proposals contained in the Liberal Party's publication, "We Can Conquer Unemployment," and we do not think that, speaking generally, there is much fault to be found with them. Indeed, it is significant that no effective criticism of this item in the Liberal Party's programme dealing with unemployment has yet appeared, either from political or economic quarters, in spite of the admission by the Minister of Labour that the proposals had been submitted to Departmental experts for rigorous criticism. In themselves, the proposals are not new; they have been consistently urged by T.D.A. since its inception, and the whole case, in its particular bearing upon the question of unemployment, was submitted in detail by the Association to the Prime Minister in the autumn of last year.

The concessions in the direction of increased facilities in rural areas announced in the Budget speech are certainly welcome, and a definite step in the right direction; but we shall not get really adequate telephone development in this country, not even that degree of development which is justified by the profitable nature of the investment, until there is a radical change in the present attitude of the Treasury towards a nationally-owned enterprise which pays its own way, earns its own keep, and docilely hands over to the Treasury an annual surplus which is applied, not, as might be expected, to extending the business or to the benefit of subscribers, but towards other commitments of the Treasury.

Meanwhile, there are, we believe, several experiments which deserve to be tried out; as, for example, the idea of applying the fashionable instalment system to the telephone system, in other words, monthly accounts for telephones. It is quite true that a certain amount of extra bookkeeping cost would be involved, but experience, in America at any rate, is that this is more than compensated for by a marked increase in the number of subscribers, and consequently in the revenue from rentals and calls.

Telephone Development Association.
H. E. POWELL-JONES, *Secretary.*

London, *May 2nd*, 1929.

Proposed Technical Society for Meter Engineers.

With reference to the proposal put forward by your correspondent, Mr. H. F. Hudson, dealing with the proposed formation of a new technical association for meter engineers, may I, as a junior assistant, express my whole-hearted appreciation of his enterprise, and the step he has taken to assist the future generation of meter engineers?

The majority of juniors are finding it extremely difficult to follow the few lectures given dealing with their chosen profession and, moreover, cannot purchase a booklet upon metering to compare in any way with the monthly pamphlet which was published by the old M.E.T.A.

It would seem that many of your correspondents do not pay much heed to the needs of junior meter engineers, who are not in the fortunate position of being able to attend—even if they wish—the lectures given at the I.E.E.

There are many who are confident that such a society as that suggested would do good, and bring both the young and older meter engineers together; and not keep them apart as now is the case.

W. S. B.

April 29th, 1929.

"Bluffing" the Public.

While much has recently been written in the technical Press on educating the public to the dangers of shoddy electrical installations and bogus contractors, an interesting case came before the writer a few weeks ago.

A person called at an electrical shop for some accessories and asked what terms he could have as he was in the trade. On being asked whether he had a card, he produced a card bearing his name, and in rather bold type underneath were the initials M.I.E.E., then followed "Electrical Contractor" and the address, which was a private one.

As there was some doubt as to the person's *bona-fides*, he was asked to pay cash. On referring to the various registers and the I.E.E. list of members, no such person's name appeared. The matter was taken up with the secretary of the I.E.E. in order to verify whether the person was entitled to use the initials M.I.E.E. after his name, and a reply was received stating that the person was not a member and therefore not entitled to use the initials M.I.E.E. The matter was then referred to the legal advisors of the I.E.E., who communicated with the person in question and received from him an apology and a promise that the use of the initials would be discontinued at once.

One learns that in the circumstances it is not proposed to take any further action, but what is to be done to protect the public against such false representation? Should not such persons be compelled to make a public apology through the local and technical Press? If not, under the present ruling it appears that any Tom, Dick or Harry can have cards printed and include the initials M.I.E.E. after his name, distribute

them throughout a district, and then, when found out, all he needs to do is to write an apology to the I.E.E.

How are the recipients of these cards to learn of such "bluffing"?

A. D.

Hanley, Staffs.
May 4th, 1929.

The Sulphur and Grit Problem.

This is a very serious matter when it is considered that in burning a ton of coal from 50 to 80 lb. of concentrated sulphuric acid is produced: hence consternation *via* Press—*The Times* Technical Publication. The prevailing idea is that this terrible nuisance cannot be feasibly overcome, which is erroneous, simply because it has been tackled in the wrong way, *i.e.*, after combustion, which is courting failure, instead of before. Many factors nullify success after combustion, *viz.*, the very large volume of flue gases, hot condition and the highly diluted state of the sulphurous oxide, which becomes sulphuric acid on mingling with damp atmosphere. A striking instance of the damaging effects is to be plainly seen in the eating away of the top portion of the iron chimneys at the Barton, Manchester, generating station; there are ragged portions from 4 to 7 in. completely eaten away; if it will eat through iron like this in a short time, it requires no undue labour of the mind to gauge the pernicious corrosive effects on property, vegetation, and lungs.

There is an improved process of fuel utilisation that will not only thoroughly eliminate the sulphur and grit nuisance, but will at the same time reduce the fuel account fully 50 per cent. at any generating station.

Chemical Engineer.

May 4th, 1929.

[Congestion of space has necessitated the publication of several letters being deferred until next week.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

26,844. "Electric switch structure and mechanism for actuating the same." A. E. White (Bastian-Morley Co.). October 10th, 1927. (309,415.)

26,845. "Electric liquid heaters." A. E. White (Bastian-Morley Co.). October 10th, 1927. (309,416.)

26,906. "Röntgen-ray photography." K. Meyer. October 11th, 1927. (Convention date not granted.) (286,283.)

29,707. "Electric winding-up mechanism for clock works." B. Krausse. November 7th, 1927. (309,386.)

33,603. "Variable-resistance shunts." G. L. Porter and Ferranti, Ltd. December 12th, 1927. (309,514.)

33,888. "Electrical relays and relay systems." J. Solomon. December 14th, 1927. (309,615.)

35,030. "Electric telegraphic receiving and retransmitting or reproducing apparatus." Creed & Co., Ltd., F. G. Creed, and R. D. Salmon. December 24th, 1927. (309,388.)

1928.

295. "Relays and controlling apparatus energised by alternating electric currents." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. January 4th, 1928. (309,515.)

529. "Device for feeding low-tension measuring instruments from high-tension systems." Trub, Tauber & Co., and A. Imhof. January 6th, 1927. (283,185.)

549. "Electric devices for drying the hands." O. Aldinger. January 7th, 1928. (309,422.)

564. "Electrical fuses." R. Lomax, J. R. Garner, and P. C. Walker. January 7th, 1928. (309,463.)

569. "Lighting units." Thermal Syndicate, Ltd., and Sir R. A. S. Paget. January 7th, 1928. (309,464.)

685. "Manufacture of cores for electromagnets or the like." General Electric Co., Ltd., W. Singleton, and G. C. Marris. January 9th, 1928. (309,394.)

712. "Electric differential drive for drilling." E. E. Greve and Oil Well Supply Co. January 9th, 1928. (309,397.)

732. "Automatic electric current regulators." J. Stone & Co., Ltd., and W. R. Chaplin. January 9th, 1928. (309,398.)

748. "Electric insulators or the like." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 9th, 1928. (309,426.)

752. "Telephone systems." Associated Telephone & Telegraph Co. May 23rd, 1927. (291,045.)

753. "Telephone systems." Associated Telephone & Telegraph Co. May 23rd, 1927. (290,998.)

810. "Ignition spark-plug heating devices of internal-combustion engines." C. D. Groves. January 10th, 1928. (309,428.)

823. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. January 10th, 1928. (309,431.)

824. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. January 10th, 1928. (309,520.)

905. "Process for obtaining steel from electric furnaces." Soc. Anon. Fonderia Milanese Di Acciaio. January 10th, 1927. (283,489.)

908. "Telephonic receivers." W. J. Rickets and A. H. S. MacCallum. January 10th, 1928. (Cognate application, 5,436/28.) (309,469.)

1,009. "Apparatus for amplifying and projecting sound from aircraft." A. E. White (Plane-Speaker Corporation). January 11th, 1928. (309,617.)

1,013. "Lead-through insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 11th, 1928. (309,472.)

1,048. "Lighting of and direction-indicators for motor road vehicles." F. A. Pilkington. January 12th, 1928. (309,521.)

1,078. "Electrical rail connectors." A. A. J. Briois and P. F. R. Betrand. January 12th, 1928. (Convention date not granted.) (284,601.)

1,224. "Electrolytic rectifier." S. D. White and R. J. Jones. January 13th, 1928. (Cognate application, 33,016/28.) (309,622.)

1,310. "Telephone systems." Associated Telephone & Telegraph Co. February 14th, 1927. (285,365.)

1,315. "Light-sensitive discharge devices." Electrical Research Products, Inc. April 6th, 1927. (288,539.)

1,339. "Voltage-regulating devices for supply systems comprising variable-speed dynamos." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 14th, 1928. (309,631.)

2,447. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,333.)

2,454. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,334.)

2,458. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,335.)

2,792. "Doors for electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. January 28th, 1928. (309,652.)

2,793. "Heating elements, particularly for electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. October 25th, 1928. (309,653.)

3,466. "Disposal of electrostatic charges on kinematograph films." P. H. Nicollic and M. J. E. Claude. February 3rd, 1928. (309,659.)

4,269. "Luminous reproductions of circuits." Siemens & Halske Akt. Ges. April 6th, 1927. (Addition to 283,893.) (288,246.)

4,513. "Process for manufacturing dynamo brushes." Dr. C. F. Von Siemens, Dr. H. Von Siemens, and Dr. A. Franke (trading as Siemens and Co., Geb.). March 29th, 1927. (Addition to 285,081.) (287,895.)

4,525. "Electric lighting systems of motor-cycles and the like." J. H. Runbaken. October 15th, 1928. (309,669.)

4,879. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. February 16th, 1928. (Cognate application, 17,356/28.) (309,670.)

6,286. "Electric switches." J. A. Crabtree. February 29th, 1928. (309,681.)

6,602. "Electric lamps." A. L. Davis. March 2nd, 1928. (309,688.)

6,679. "Dynamos for use on motor vehicles." Wolseley Motors (1927), Ltd., and O. Boden. March 3rd, 1928. (309,690.)

7,353. "Construction of cathodes for electric discharge devices." De Forest Phonofilms, Ltd. April 27th, 1927. (289,424.)

7,462. "Electric fans." Revo Electric Co., Ltd., and F. H. Reeves. March 10th, 1928. (309,698.)

7,494. "Electromagnetic switches." G. Meikle. March 10th, 1928. (309,699.)

7,595. "Electric vacuum tubes." British Thomson-Houston Co., Ltd. March 14th, 1927. (287,089.)

7,948. "Electric relays." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz and Soc. l'Action à Distance. April 8th, 1927. (288,263.)

8,285. "Overload circuit breaker." W. Layhausen. March 19th, 1928. (309,704.)

8,608. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. March 21st, 1928. (309,711.)

8,843. "Electric switches." General Electric Co., Ltd., and W. Manchester. March 23rd, 1928. (309,714.)

9,177. "Protective arrangements for electrical heating apparatus." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. March 26th, 1928. (309,720.)

9,410. "Safety electric lamps." Ceag, Ltd., and R. J. Plummer. March 28th, 1928. (309,721.)

10,613. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). April 10th, 1928. (309,733.)

12,403. "Variable electric condensers." Lissen, Ltd., and R. P. Richardson. April 27th, 1928. (309,748.)

13,676. "Mercury-tube switches." I. E. McCabe. December 5th, 1927. (301,792.)

15,034. "Protective gear for alternating electric current systems." T. W. Ross and Associated Electrical Industries, Ltd. May 22nd, 1928. (309,766.)

15,373. "Photographic recording and reproduction of sound." Westinghouse Electric and Manufacturing Co. May 26th, 1927. (291,105.)

15,433. "Dry cells." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased)). (National Carbon Co., Inc.). May 25th, 1928. (309,769.)

15,783. "Fastening devices for electrical leads or conductors." J. Andvig. May 30th, 1928. (309,772.)

17,018. "Controllers for electric motors." R. B. Hunter. June 27th, 1927. (292,949.)

17,514. "Tap-changing switches for electric transformers." Siemens-Schuckertwerke Akt. Ges., K. Kurda, W. Wernicke, and C. Oertel. June 16th, 1928. (309,780.)

20,806. "Electric welding." H. D. Fitzpatrick (Maatschappij tot Vervaardiging van Snijmachines Volgens van Berkel's Patent en van Andere Werktuigen). July 18th, 1928. (309,796.)

22,029. "Electric lamp holders." International General Electric Co., Inc. July 30th, 1927. (294,887.)

24,445. "Telephone systems." Associated Telephone & Telegraph Co. March 14th, 1927. (Divided application on 287,079.) (296,069.)

24,447. "Telephone systems." Associated Telephone & Telegraph Co March 14th, 1927. (Divided application on 287,079.) (296,070.)

30,684. "High-tension cables." British Thomson-Houston Co., Ltd. October 25th, 1927. (299,394.)

31,152. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd. October 28th, 1927. (299,472.)

31,858. "Telephone systems." Associated Telephone & Telegraph Co. May 25th, 1927. (Divided application on 291,045.) (299,814.)

36,542. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (Divided application on 288,234.) (302,238.)

36,544. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (Divided application on 288,324.) (302,240.)

36,562. "Electric apparatus for heating liquids." A. E. White (Bastian-Morley Co.). October 10th, 1927. (Divided application on 309,416. (309,436.)

1929.

903. "Röntgen diaphragm." K. Mayer. October 11th, 1927. (Divided application on 286,283.) (309,529.)

1,575. "Device for feeding low-tension measuring instruments from high-tension systems." Trub, Tauber & Co., and A. Imhof. August 10th, 1927. (Addition to 283,185.) (Divided application on 283,185.) (304,218.)

3,769. "Thermionic and the like amplifiers." W. S. Smith and N. W. McLachlan. January 12th, 1928. (Divided application on 1,114/28.) (309,635.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 1st:—

Fulgura. No. 500,613. All goods in Class 6. No. 500,614. All Class 13. No. 500,615. All Class 18.—Bergmann Elektricitätswerke Gesellschaft, Berlin. (British representatives: Abel & Imray, 30, Southampton Buildings, W.C.2.)

Lion. No. 493,863. Class 8. Telephonic loud-speakers.—Graham Amplion, Ltd., 37, Walbrook, E.C.4.

Transonic. No. 500,040. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—F. G. Woodwall, St. Helier, Jersey. (British representatives: Gee & Co., 51, Chancery Lane, W.C.2.)

Keepalite (lettering and design). No. 499,053. Class 18. Emergency lighting installations for buildings.—Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE. — Domestic science department, West End schools, for the Borough E.C.; G. W. Handforth, director of education (returnable deposit of £2 2s).

BEDFORD.—Block of business premises, for the Co-operative Society; W. H. Guest Hubbard, architect, 35, Manchester Street, Luton.

BEXHILL.—Converting Nos. 29, 52 and 54, Western Road, into shops; J. H. Lye, Chepbourne Road.

BIRKENHEAD.—Rebuilding offices, Catherine Street; Co-operative Society.

BOLTON.—Works extension, Blackhorse Street; Kay & Co. Administrative buildings, for water department, Sweetloves; John Dickinson & Co. (Bolton), Ltd. Extensions, infirmary, Chorley Street; governors. Church and assembly hall, Halliwell Road; Free Church Council. Extensions, Moss Dye Works, Brightmet; T. and H. Twises.

BOURNEMOUTH.—Church, Southbourne Road; Immanuel Congregational Church Building Committee. Additions, National Sanatorium, Bourne Avenue; governors.

BRIGHTON.—Boys' secondary school (£47.366), for the Borough E.C.; F. T. Wilson & Sons, builders.

CARLISLE.—School, for the city E.C.; Percy Dalton, surveyor, 18, Fisher Street (returnable deposit of £1 1s.).

COSHAM.—School, Cowplain, for Hants. E.C.; A. L. Roberts, county architect, The Castle, Winchester (returnable deposit of £1 1s.).

CROYDON.—Extensions, nursing staff accommodation, Mayday Road Hospital (£13,000), for the Board of Guardians; clerk.

DARTFORD.—Extensions, King Edward Avenue Hospital, for the Board of Guardians; G. E. Burgess, architect, Station Approach (returnable deposit of £2 2s.).

DERBY.—Cinema (£120,000), for the Majestic Cinema (Derby), Ltd., with electrical and heating work; Naylor, Sale & Woore, architects, Market Place. Extensions, Babington Lane Picture House, for the Midland Electric Theatres, Ltd.; B. Dent, manager.

DEWSBURY.—Cinema, arcade of shops, &c., for the Palatine Amusement Syndicate (£70,000); C. F. Mallinson, architect.

DONCASTER.—Extensions, administrative block, for the Joint Hospital Board; Allen & Hickson, architects, 51, Hallgate.

DUNDEE.—Tramway depôt, for Corporation; George Baxter, city engineer.

DUNFERMLINE.—Police buildings (£16,000); R. H. Motion, architect.

EDINBURGH.—52 houses at Corstorphine, for Corporation; city architect.

FOLKESTONE.—Works, for the Reliance Motor Body Works Co., Park Road.

GLASGOW.—Police station, Millerston; city engineer and trade contractors.

GLOUCESTER.—Business stores, Eastgate Street, for the Co-operative Society, Ltd.; secretary.

GREAT WARLEY (Essex).—Works extensions, Woodman Road, for Selo, Ltd.

GUILDFORD.—Technical college, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

HAMPTON.—School (360 places), for Surrey Education Committee.

HIGH WYCOMBE.—Factory extensions, Newland, for W. Barrett.

HOUNSLOW.—Factory at Great West Road; Wallis, Gilbert and Partners, architects.

HULL.—96 houses, Derrington estate; Holliday & Barker. 32 houses, Eastfield Road; G. T. Rignall. Orthopædic hospital at sanatorium; city architect.

HUTTON.—Extensions, Grammar School (£31,500), for Lancs. E.C.; director of education, Preston.

KIDDERMINSTER.—Re-erection of portion of The Elms, Abberley, with electrical work, residence of Sir Richard Brooke.

KNUTFORD.—Housing scheme (140), for the U.D.C.; H. Caldecut, clerk (returnable deposit of £1 1s.).

LEEDS.—300 houses and flats, Dewsbury Road and Southfield estates; city engineer. Development, Roundhay Park estate; C. H. & F. Lax and H. Arnold & Sons, Ltd.

LEICESTER.—Houses on Braunstone estate, for Corporation, Harris Bros. (96); Chapman & Sons (110); D. Heggs (38). 114 houses, Braunstone estate; Bodill & Sons, Ltd., Hucknall. Mental hospital, Leicester Frith (£15,240); W. Potter. Elementary school, Braunstone estate; Leicestershire Education Committee. 54 houses, Saffron Lane, for Corporation; S. A. Potter. Estate development, Glenfield Road; Sherriff & Co. Aerodrome, Braunstone estate; city engineer and Air Ministry.

LEYLAND.—Secondary school (£34,350); Lancashire Education Committee.

LONDON (Camberwell, S.E.).—121 tenements and 12 shops, Oliver Goldsmith estate (£45,848); R. J. Rowley, Ltd., Tottenham.

(Stockwell, S.W.).—Additions, Spurgeon's Orphanage, Clapham Road; W. L. Cook & Co., Ltd.

(Wandsworth, S.W.).—Additions, Garrett Lane, for Imperial Chemical Industries, Ltd.; Chesterton & Sons.

(Soho, W.).—Reconstruction Royalty Theatre, Dean Street; Theatre Co.

MANCHESTER.—Technical school and clinic, Gorton (£56,000); Education Committee.

MANSFIELD.—Extensions to grammar school (£32,000), for Notts. E.C.

NEWHAVEN.—Telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W.

NETHERNE.—Extensions for extra 600 patients, sanatorium; Surrey county architect.

NORDEN.—School (£20,000), for Lancs. E.C.; director of education, Preston.

OLDHAM.—Extensions, picture house, Southgate Street; Palladium Pictures, Ltd.

OSWALDTWISTLE.—School (520 places), for Lancs. E.C.; director of education, Preston.

PEMBROKESHIRE.—Reservoir, heating, &c., mental hospital (£10,600); County Council.

ROMSEY (Hants).—Housing scheme (34), for the R.D.C.; C. W. P. Dyson, surveyor (returnable deposit of £2 2s.).

SHEFFIELD.—Library and art gallery (£95,000); city architect. Police station, Attercliffe (£13,500); city architect. Workshops for blind, Sharrow Lane (£27,356); T. Roper & Sons, Ltd.

SHIPLEY.—Warehouse, Dockfield Road; Bowden, Webb and Co., Ltd.

SMETHWICK.—Works extensions, Lewisham Road; Evered and Co., Ltd. Works extension, Cape Hill; Mansill, Booth & Co., Ltd. Transformer house, Wills Street; Wilmot & Breeden.

STAINES.—Cinema, High Street; S. B. Pritlove, London, architect; Kirk & Kirk, Putney, builders.

STOKE-ON-TRENT.—Overhead wiring for 257 houses, for City Electrical Engineer's Department; city electrical engineer, St George's Chambers, Kingsway. Two hospital pavilions, nurses' home, and dining hall, for the Board of Guardians (£100,000); W. Pendleton, architect. 40 houses, Shelton New Road, &c.; Holloway & Co.

STRATFORD-ON-AVON.—Housing scheme (44), for the R.D.C.; G. E. Boshier, architect, Bridge Street.

SUTTON VALENCE.—School (200 places), for Kent E.C.; E. Salter Davies, director of education, Maidstone.

THORNTON-CLEVELEYS.—School (500 places), for Lancs. E.C.; director of Education, Preston.

TORQUAY.—About 100 houses, Barton; borough engineer.

WEMBLEY.—Elementary school, Kenton site (£14,000); Middlesex Education Committee.

WORSLEY.—Central school; Lancashire Education Committee.

YORK.—50 houses, Burton Lane estate; Flowitt & Gilbert, Doncaster. Housing scheme, Heworth Green; city engineer.